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and The AIRCRAFT ENGINEER

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The Outlook

The R.A.F. in the Low Countries

THE invasion of the Low Countries brought the R.A.F. the opening for which it had been anxiously waiting since the beginning of the war. All the lines of communication behind the advancing German Armies were packed with reinforcements and supplies, and on them the Bomber Command let loose its squadrons. The bomber appeared in these operations in its true rôle as a long-range gun, and the destruction which it wrought was great. It did not stop the advance of the German hordes, but it took heavy toll in men and *matériel*. Everyone unites in a chorus of praise for the work of our bomber pilots. They were daring and they were clever. Admittedly, there were not enough of them. For this shortage the British authorities were not solely to blame. It must be remembered that for a period not long before the outbreak of war the French output of aircraft had sunk to almost microscopic proportions, and, though the recent recovery has been most creditable, there was still need for the R.A.F. to do a great deal of the work for the French and Belgian Armies.

Still, it remains a question to be answered after the war, when all details are known, whether any size of bomber force could have brought the German advance to a halt. The German Armies are immensely large, and their leaders are wantonly prodigal of life; the roads and railways which were used on the advance were very numerous, and, finally, bombing is less effective than shelling. Mechanised troops are not to be stopped for long by a crater in a road or by a vehicle overturned at the head of a column.

On the other hand, it is to be noted that the *Luftwaffe*, numerous as it is, has not been able to stop the embarkation of our troops from the beaches at Dunkirk. Here, again, our shortage has been noticed and deplored; this time a shortage of fighters. Those fighters have performed prodigies, and the numbers which they have shot down seem well nigh fantastic. We hope that we shall never again hear the cry that we do not need a strong force of fighters, and that three-quarters or more of our energies ought to be put into building up the Bomber Command. We need both, and perhaps it will be concluded that the Fighter Command ought to receive most of our effort—it is too early as yet to speak with confidence about desirable proportions.

Despite these great feats of our fighters, the German bombing of the Dunkirk beaches and of the vessels carrying our troops across the Channel has been incessant. According to the expectations of those who have most highly rated the powers of the bomber aeroplane, the embarkation of the B.E.F. should have been impossible. Yet it has gone on, and the great majority of our troops have been saved from what not long ago seemed likely to be a disaster of the first magnitude. The Low Countries campaign looks like affording another example of the limitations of the bomber.

The Value of Escorts

WE repeat it: the numbers shot down by our fighters make one gasp. We knew that our machines were much better than those of the Germans and we knew that the training of our men was infinitely better, but even so we never expected such wholesale slaughter of German aircraft. The figures made public are not easy to check, but it seems that a very large proportion of our victims have been German fighters of the two Messerschmitt categories. That is satisfactory as a proof of our fighter superiority; but it also implies that the German escorts have succeeded to a considerable extent in performing their function of drawing off our attention from the bombers which they were escorting, and so allowing the bombers to reach bombing position. That is not so satisfactory, and again shows that we need more fighters, and still more fighters.

Great Fighting

AMONG the incidents of the fighting two have been agreeable surprises. In the first place the Defiant has made a most sensational début. We had had high hopes for it, but until it had been in action we could not feel sure that it would be a success. We may remember that originally the Bristol Fighter was not a great success, and the author of the official *War in the Air* commented that at first our pilots made the mistake of trying to attack with the rear gun, and that it was only when they used the front gun for attacking that the Bristol Fighter came into its own. In the Defiant we have staked all on the four guns in the rear turret, and the first day's fighting by a Defiant squadron seemed to show that the tactics were right. A report has come through that German pilots mistook the Defiant, when sighted head on, for either a Hurricane or a Spitfire, and took action to avoid the fire of the wing guns; but were absolutely taken by surprise when four guns opened fire on them from the rear. A surprise like that has only a temporary effect, but German pilots may still be left guessing when they see a low-wing monoplane coming at them.

Another truly great fight has taken place between three Ansons and nine Mes. 110. The somewhat ancient and lightly armed reconnaissance machines of the Coastal Command shot down two of the latest fighters of the *Luftwaffe*, badly damaged two others, and drove off the rest. The Ansons had two men wounded. Such a result was not to be expected. Nine modern fighters ought to be able to shoot down any number of reconnaissance aircraft. Of course the fighters might lose one from a lucky shot, but they ought not to lose four and let their quarry escape.

The gunners in the Ansons must have been magnificent; but does that cover the whole matter? One can hardly help supposing that the pilots of the Messerschmitts were of poor quality.

Civil Aviation

IN this issue we publish the first instalment of the Wilbur Wright Memorial Lecture by Dr. Roxbee Cox. We are sure it does not overstate the case to say that no more significant document on civil aviation has ever appeared in this country and it is a very great contribution to the advancement of an engineering activity devoted to civilising purposes. It is not only a contribution but also a tribute—a very sincere tribute to that great man after whom the lecture is named.

Dr. Cox is gifted with an imagination, but albeit an imagination disciplined by science and engineering. By means of this gift he has looked into the future and has told us of things for which we must prepare so that the future when it arrives will not find us wanting. More than that, he has measured these things, and that is where his scientific training justifies itself. By the use of his great gifts he has drawn the plan for the structure of our Imperial civil aviation, one of the units of world civil aviation which will operate over this globe as soon as the present wave of barbarism has subsided.

He has drawn the plan. It is a worthy piece of work, and the fault is ours if we do not follow it out. The blame will be on the shoulders of our Government and our Government departments if, as soon as is possible, the British Empire is not provided with an air transport system worthy of itself by implementing this plan drawn up for the purpose by one of the younger aeronautical scientists.

A HEAVY AMERICAN: The Consolidated XB-24 bomber (four Pratt and Whitney Twin Wasps) which weighs about 40,000 lb., has a span of 110 ft. and carries a crew of from six to nine persons depending on the job to be undertaken. There is a turret in the tail. The machine is known by the makers as the Model 32 and the wing, of high aspect ratio, is of similar design to that used on the Model 31 flying boat.

WAR in the AIR

The Battle of Dunkerque : Debut of the Defiant.

THE invasion of the Low Countries has brought the *Luftwaffe* into its proper rôle, as the Horse Artillery of the German Army. It has repeated the tactics which were found so effective in Poland and, to a lesser extent, in Norway, by assailing the back areas of the opposing forces and so preparing the way for the onrush of the German mechanised ground troops. It has also disgraced itself by the brutality with which it has bombed civilians, refugees, hospitals and hospital ships. The American Red Cross unit in Belgium has found it wise to remove the red crosses from the tops of its ambulances, as they invariably drew fire. The destruction of the American hospital at Ostend was a particularly cold-blooded piece of work, and the carnage among civilian patients, nurses, and doctors, is believed to have been terrible. After the walls had collapsed, incendiary bombs finished the business.

King Leopold of the Belgians astounded and shocked the world by sending a plenipotentiary to the Germans on Tuesday, May 28, and asking for an armistice for the Belgian Army. The Germans naturally accepted, and the Belgian Army was accordingly ordered by the King to lay down its arms. The Northern group of Allied Armies, French, British and Belgian, were under the supreme command of General Blanchard, but King Leopold acted without consulting or warning him or General Gort. The reason for his action has not been made public, but the Belgian Government, now in France, strongly dissociated itself from this action and affirmed that Belgium is still at war by the side of her Allies. None the less, this defection left the North Eastern flank of the Allies exposed, and the German troops rushed forward to try to cut them off from the coast and, if possible, to surround them. The French and British contrived to reform some sort of line and to stem this rush, while French Marines landed at Dunkerque and established an entrenched camp there from which it might be possible to withdraw the Allied troops. Flood gates were opened so that the German advance might be checked. Other British troops were withdrawn from Boulogne on destroyers after a most heroic fight in which soldiers and sailors rivalled each other in *sangfroid* under heavy shelling and bombing. The rearguard action of the B.E.F., many of the troops being young and inexperienced, is acclaimed as one of the most gallant feats of arms of all times, and has been compared to Sir John Moore's retreat to Corunna.

The hardships of our troops have been intensified by the constant bombing. Shelling is bad enough, as veterans of the last war know ; but one can be withdrawn out of the range of shells and get some rest. The bombs are not to be evaded in that way. It was a moment for the Royal Air Force to give of its best to

It was related last week how a Blenheim pilot, attacking a Fieseler Storch, was astonished when "the enemy aircraft appeared to stop and stand still in mid-air." Here is a new picture of one of these slow-flying army co-operation aircraft.

These pilots, air gunners and observers, belonging to a Battle squadron stationed in France, have done an amazing job of work bombing enemy communications. This flight has been in France since the declaration of war.

WAR IN THE AIR (CONTINUED)

One of the new Dewoitine D.520 single-seater fighters of the French Air Force. The armament is one Hispano-Suiza 20 mm. shell-gun and four Browning machine guns.

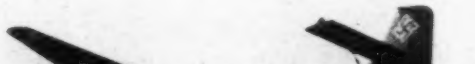
help the Army in its hour of sore need, and right gallantly have they answered the call. Our bombers have flown day and night in the endeavour to hold up the advance of the German tanks and other troops, and have done immense damage to the enemy. Yet still the Germans have come on. The vast hordes of German troops have been hurled into the fray, regardless of losses; but with numbers on their side it has been possible for the German Generals to give some rest to wearied battalions. For the Allies no rest has been possible; they have had to fight day and night, and day after day. Blenheims, Beauforts, Battles, Wellingtons, Whitleys, and Lysanders have been mentioned in the communiqués as having played their part in bombing the German columns, and their losses have been small in comparison with the efforts they have made.

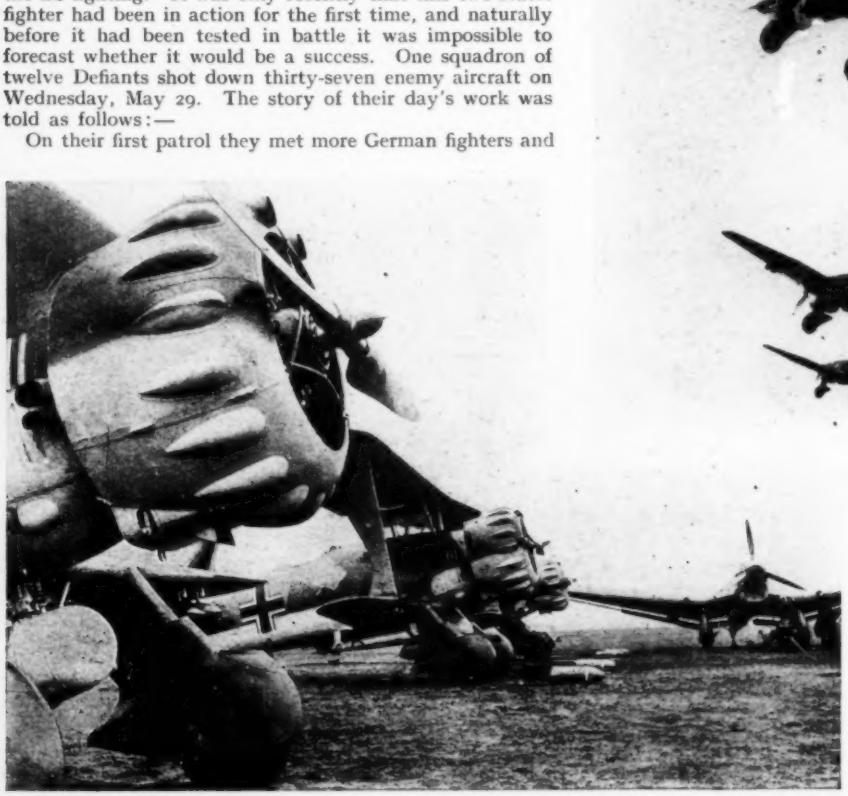
Our fighters, too, have been simply magnificent. Adverse odds mean nothing to them, and they attack German formations wherever they find them, regardless of their numbers. They have wrought great havoc.

The outstanding success of a squadron of Boulton Paul Defiants has been one of the most gratifying features of the air fighting. It was only recently that this two-seater fighter had been in action for the first time, and naturally before it had been tested in battle it was impossible to forecast whether it would be a success. One squadron of twelve Defiants shot down thirty-seven enemy aircraft on Wednesday, May 29. The story of their day's work was told as follows:—

On their first patrol they met more German fighters and dive bombers than they could count. They brought down 17 of the fighters as well as a dive-bomber. On their second patrol, later in the afternoon, they shot down 19 and possibly 21 bombers.

During their first engagement, one of the squadron's air





Junkers Ju 87 dive-bombers have proved a nuisance to the infantry, artillery and mobile units but are easy meat for our fighters.

In the foreground are Henschel Hs 123 single-seater dive-bomber biplanes. These machines have BMW 132 engines. The Ju 87 in the background is of the old type.

WAR IN THE AIR (CONTINUED)

The underslung observation car of a French reconnaissance machine showing the point of entry of a small-calibre shell.

gunners, apparently believing that his aircraft had been vitally hit, baled out over Belgium. Otherwise, every British Defiant, every pilot, and every gunner returned safely.

On their after-lunch patrol over Dunkerque, the Defiants first sighted seven Me. 109s. They immediately attacked and one of the Me.s was shot down. Hardly had this fight finished when the British Defiants were surprised by four more Nazi fighters diving on them out of the sun and firing a stream of cannon shells. One of the Defiants was then hit but was able to reach home safely. It was from this fighter that the gunner jumped. After a dog fight between the remaining Defiants and the other Me.s the Nazi fighters finally disappeared. Then the British squadron saw two formations of nine He. 111 bombers, which were attempting to bomb Dunkerque, but all their bombs fell into the sea. They were attacked by British Hurricanes, so the Defiants looked for other quarry. Circling above them, ready to dive and attack, were a number of Me. 110 twin-engined fighters. There was another dog fight in which 16 of the Nazi fighters were destroyed. Mixed up in this engagement were 30 to 40 Ju. 87 dive bombers which were also attempting to bomb Dunkerque. One of these aircraft was also destroyed by the Defiants. The British fighters continued the action until they had exhausted all their ammunition and then made for home. On their second patrol, the Defiants again encountered large numbers of dive bombers. They shot down eighteen Ju.87s for certain, and possibly another two as well. The Defiants had still some ammunition left and resumed their patrol. They then met a Ju. 88, flying on its own. Having shot it down, they again set off for home.

During the three days, May 27, 28, 29, this squadron destroyed fifty enemy aircraft.

The squadrons of Hurricanes and Spitfires were not backward in the good work, and on an average forty enemy machines have been shot down every day in the Low Countries battle. It has been estimated that in the three weeks since the invasion of Holland and Belgium began the Germans have lost roughly two thousand aircraft. This figure probably includes machines destroyed on the ground (when the crews may have reached cover) and also those shot down by A.A. guns. In the actual air fighting it is reckoned that British losses have been only about a third of those of the Germans. It may be noted that a large proportion of the German machines shot down by R.A.F. fighters have been German fighters escorting bombers. That implies that the escorts have achieved their object in allowing the bombers to get to their objectives, while the escorts sacrificed themselves in occupying the attention of the Allied fighters.

The enemy has been using some rather venerable aircraft in this battle. One formation of Blenheims was attacking a column of small armoured fighting vehicles and supply lorries when it was attacked by German two-seaters, which may have been Henschel 123 dive-bombers. At any rate they made off in haste when they saw British fighters flying up to the rescue. On another occasion, during the embarkation, it was reported that old Heinkel 51 biplane fighters attacked our troops. A French correspondent has suggested that the Germans may be reserving the pick of their pilots for an attack on Britain, as some of the pilots taken prisoner have had very few hours' flying. On the other hand, it may be that the German losses are already making an appreciable impression on the supply of trained air crews. With her huge aircraft industry, the loss of machines cannot yet mean very much to the *Luftwaffe*, but the supply of good air crews is not able to keep pace with the outturn of aircraft, and the need to economise petrol has undoubtedly affected the ability of the German pilots. They are not, on the average, to be compared with British and French pilots in skill.

It is not possible in one article to publish all the stories which have been told of the work of our fighters and bombers, but the following have been selected out of a great number.

A young New Zealand fighter pilot brought his

An attack by the Royal Air Force on an enemy transport concentration parked in a yard at Samer.

damaged Hurricane safe to England from France after an extraordinary experience. The aircraft was severely damaged before the pilot left on his journey home. The gun-sights were gone, and the only instruments working were his compass and oil-temperature and pressure gauges. He had no incendiary or tracer ammunition, but his eight machine guns were loaded with ordinary ammunition. The pilot was concerned chiefly about the starboard petrol tank which was leaking. He, therefore, decided to land at an aerodrome in Northern France to refuel before continuing his flight to England. When he was approaching the aerodrome he saw that part of the town near-by was in flames, and, just as he was preparing to come down from 5,000ft., he observed two Dorniers 215 begin a dive-bombing attack on the aerodrome. Immediately he got on the tail of one and gave it two short bursts. There was no doubt that he hit the enemy aircraft, although he had no gun-sights. The second German machine tried to escape in the clouds, but the Hurricane pilot followed it, blazing away with his guns. Having got rid of the two Dorniers, the New Zealander was about to land when he was attacked by a number of Messerschmitt fighters. Unable to cope with all of them immediately, he circled the town for about ten minutes, giving them occasional bursts. When he landed at the aerodrome, he found that his starboard tank was spurting petrol. The men on the ground refused to fill his tanks, saying that it would be suicide to go up again in that machine. So the pilot had to compromise. He had his port tank fuelled, and with a bayonet widened the holes in the punctured tank to allow the fuel to escape. Then he took off again, although he had only 50 rounds left in each of his eight machine guns. "With only that small amount of ammunition I was almost helpless," he said later. "It was just my luck to run into another formation of six Messerschmitts when I was practically out of petrol. Anyway, I gave the leader a burst as he came head-on for me (I'm sure I hit him), and I dived down past him towards the ground. After that I just 'put my skates on' for home. It was good fun—that flight. But what would I not have given for more ammunition to deal with the Messerschmitts!"

Heavy German Losses

BETWEEN 5.30 and 9.30 on the morning of Sunday, May 26, R.A.F. squadrons shot down at least 20 German bombers and fighters and put another 20 out of action. There were only five British casualties in these four hours of fierce fighting. A continuous air battle was fought over the French coast between Calais and Dunkerque. Pilots reported that "the sky was filled with aircraft." A squadron leader spoke of encountering "large masses of Messerschmitt 109s." One formation of Ju. 88s was trying to bomb ships when a Spitfire squadron approached. Five Messerschmitt 110 twin-engined fighters protecting the bombers were put out of action, and one of the bombers was destroyed. This brought the squadron's "bag" of enemy aircraft in three days to 32. Twenty Messerschmitt 110s were surprised 17,000ft. over Calais. Approaching from the sun, British fighters broke up the defensive circles which the Nazi fighters tried to form. The Messerschmitts twisted and turned in their efforts to manœuvre into a more favourable position, but the British fighters put five of them out of action. An hour and a half later the same squadron destroyed five more Messerschmitts, damaged another five, and brought down an army co-operation aircraft. A fight starting at 10,000ft. ended low over the French fields, with Junkers 87 dive-bombers "hedge-hopping" in all directions as they tried to escape from the attacking Spitfires. Before their protecting Messerschmitts could arrive the Spitfires shot down five and damaged three more.

Monday, May 27, was the best day for British fighters since the invasion of the Low Countries. They destroyed or seriously damaged seventy-nine German raiders. Fifty were seen to crash and the other twenty-nine flew off disabled. Fourteen of our Hurricanes and Spitfires were missing, though some of the pilots are believed to be safe. For sixteen hours the fighter pilots patrolled the sky over the battlefields and the French and Belgian ports. The first Messerschmitt 109 was destroyed by Spitfires before 6 a.m. The last Dornier 215 bomber was shot down by Hurricanes just before 9 p.m. It was a bad day for the German Messerschmitt fighters. Twenty-two of them were destroyed and another nine put out of action.

The same night, May 27, heavy bombers attacked military objectives at Dusseldorf, Duisberg, Dortmund, Hamburg, Bremen and Cologne. All our aircraft returned, one shooting down an enemy scout over Holland.

No fewer than 52 enemy aircraft were shot down on Wednesday, May 29, including 25 bombers. Seventeen others were seriously damaged. Ten of our fighters are missing, but one of the pilots, although wounded, has since returned safely.

The Maastricht Bridge

GENERAL GEORGES, Chief of Staff to Allied Generalissimo Weygand, recently sent a message of congratulations to an R.A.F. bomber squadron in France. It read: "Messieurs, je vous remercie"—"Gentlemen, I thank you."

This compliment was given for destroying the famous bridge over the Meuse. All the bridges over the Meuse near Maastricht, where the Germans were making their thrust to divide the Allied forces, had been blown up except one. Over that bridge poured the tanks and armoured units of the enemy advance. Stores, petrol, ammunition—everything came over that one bridge. It was heavily defended. A.A. guns kept up a barrage of fire, enemy fighters maintained constant patrols. Eight attacks were made by our bombers. The river banks were shattered by high explosives; fighters were shot down in flames; A.A. batteries bombed out of action. But no direct hit was scored on the bridge. Still the enemy advances poured over that one crossing. At the R.A.F. squadron headquarters the commanding officer made a short speech to his pilots. The bridge must be destroyed. Volunteers were wanted. The pilots stepped forward as one man. So they wrote their names on slips of paper and put them in a hat. Four crews were chosen. They went off without waiting. Fighters went up as escort and they made straight for the bridge at Maastricht. Our fighters took on the enemy's fighter guard, welcoming all odds to give the bombers their chance. Facing a blizzard of enemy fire the bombers dived low on their target. Of those four crews one man came back. But the bridge at Maastricht was blown up.

Both Army and Navy have testified to the great work done by the R.A.F., helped at times by the Fleet Air Arm, in relieving the pressure on the embarkation of the B.E.F. at Dunkerque. On Wednesday, May 29, our fighters destroyed at least 70 enemy aircraft. On Friday, May 31, the F.A.A. bombed German columns on roads, and one pilot saw his bombs make a direct hit on a large open touring car escorted by two motor cycle outriders. On that day 56 enemy aircraft were destroyed or seriously damaged, while 16 of our fighters were missing. That day, it may be recalled, was the anniversary of the battle of Jutland. Next day, the "Glorious First of June," another anniversary of a British naval victory, our fighters shot down or severely damaged 78 German bombers and fighters, of which 42 were seen to crash into the sea off Dunkerque. One Spitfire squadron that day shot down 18 enemy aircraft. Sixteen of our machines failed to return.

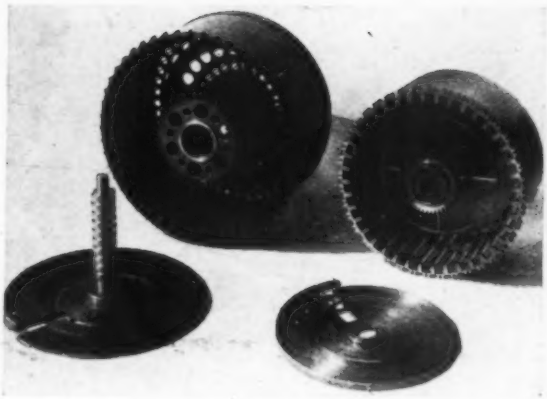
On June 1 the petrol and oil stores at Rotterdam were bombed once more by the Coastal Command, and the crews who took part believe that those stores have now been totally destroyed.

A most remarkable feat on that same day was a victory of three Avro Ansons over nine Messerschmitt 110s between Calais and Ostend. Two of the enemy were shot down, two were disabled and the rest flew away.

A POWER-DRIVEN GUN

High Rate of Fire : Similarity to Messerschmitt Shell-gun ?

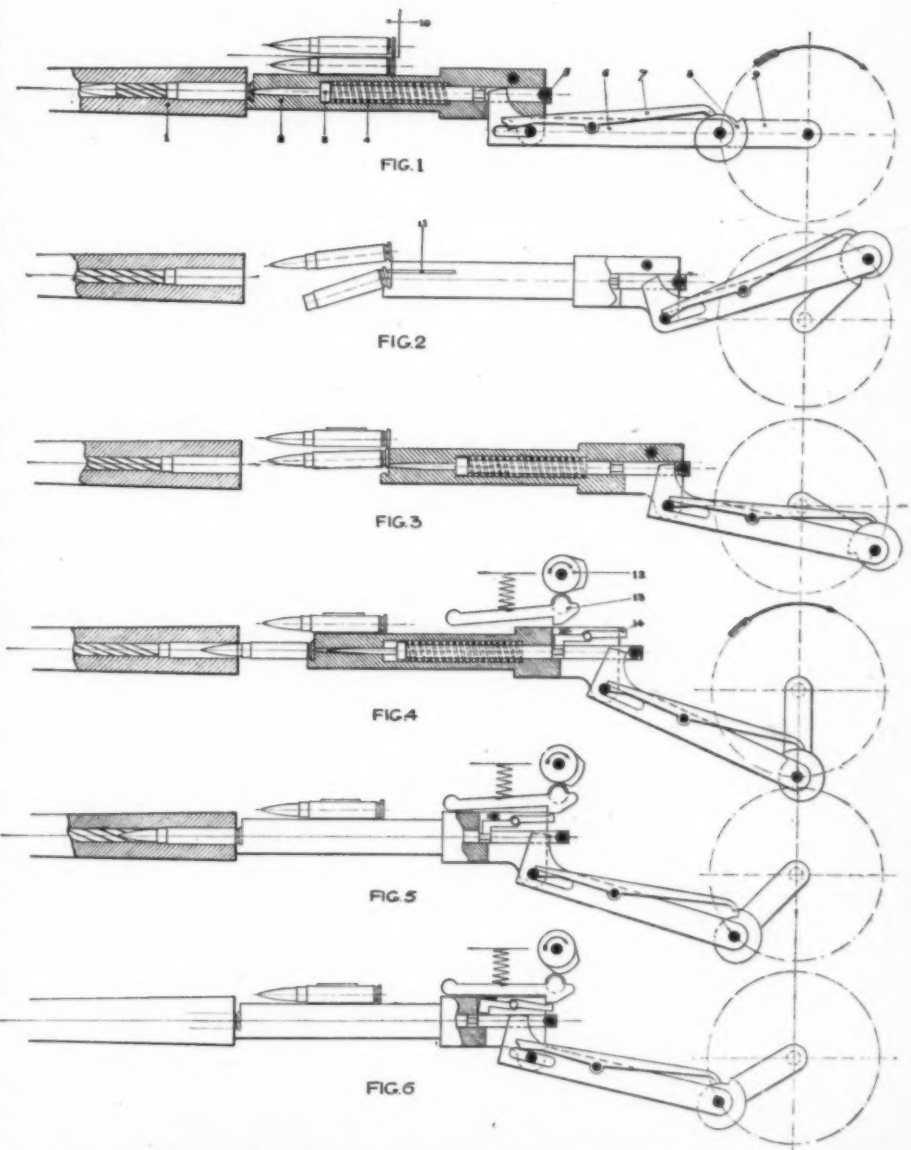
MENTION was first made of the installation of shell-firing armament on Messerschmitt fighters during the Spanish Civil War. It is said that one "Me" shot down by Government troops was carrying armament of this type, and, although badly damaged, a gun was forwarded to the technical branch of the French Army. According to an armament designer in this country, it was found similar in design to a gun he had developed in Germany in the years before Hitler assumed power.



Two sizes of drum which differ in design. The larger one holds 400 rounds of rifle-calibre ammunition.

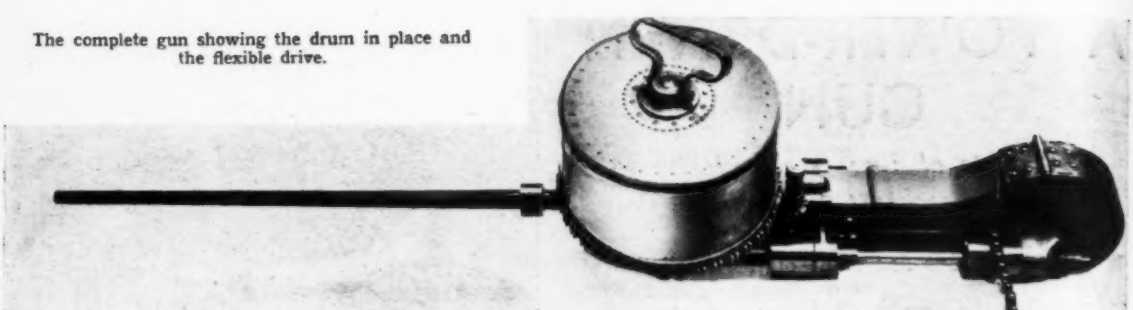
This was a power-driven weapon which at first fired 1,200 rounds a minute. A developed type is said to have attained 1,600 rounds a minute and the latest model 2,000 rounds a minute. The gun, in rifle-calibre, can be worked by any motor, a minimum of ¼ h.p. being necessary. Its operation can best be followed with the aid of the accompanying drawings.

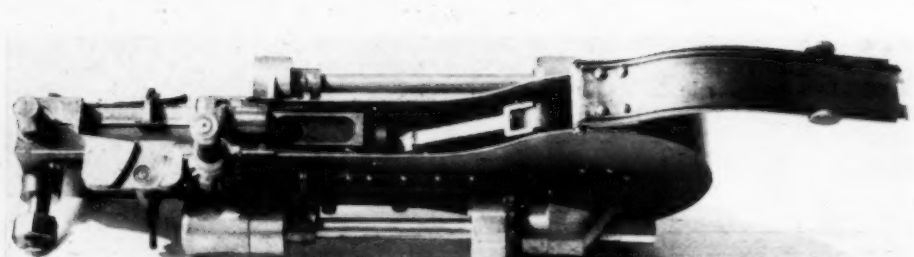
The drive for loading and extracting is by the crank driving gear (9) which is yieldingly connected with the lock (2). This lock contains the striker pin (4) bearing a roller (5) in its slit end. The claw of the lock fits the cartridge base and guides each round during the process of loading and extracting. Ammunition is contained in a circular magazine (10) above the gun. During firing the cartridges are guided from the drum by a device connected with the crank driving gear. The blocking of the lock during firing is effected by an arm (13) which is likewise set is motion through being connected with point (12). Besides this function it releases the firing pin which is drawn back by the connecting rod nose and held fast by lever



A diagrammatic representation of the functioning of the power-driven gun described herewith.

The complete gun showing the drum in place and the flexible drive.





In the view on the left, the top strap has been folded back to show the internal mechanism. It is claimed that the gun is lighter than the normal German M.G. 08, weighing about 26½ lb.

No. 14. The crank carries a cam (8) on which the end of lever (7) bears.

Fig. 1.—The crank is in its front dead centre position. The shot has just been fired and the lock is still blocked The connecting rod starts its rearward motion.

Fig. 2.—The connecting rod has taken the released lock with it and the joint lever connects the connecting rod and block. The ejector is set in motion.

Fig. 3.—The nose of the connecting rod is next to the roller on the percussion bolt which it begins to strain. Another round is pressed from the drum. The crank driving gear has passed the rear dead centre position and begins to push the lock forward.

Fig. 4.—The nose of the connecting rod has compressed the spring of the percussion bolt. A lever (14), worked by a spring, keeps the bolt fast. A new round has already partly slid into the barrel.

Fig. 5.—The cartridge is now in place and the safety device between the connecting rod and the lock is being loosened. Part No. 13 is being pressed down by the cam and starts to block the lock. Simultaneously it presses on the rear part of (14).

Fig. 6.—The connecting rod is free and the lock has been blocked. Part No. 13 is pressed down and the percussion bolt freed. The round is fired.

Should all the claims for the gun in rifle calibre be substantiated it would be a formidable weapon not only for mounting on aircraft, but for anti-aircraft use from ships or ground positions. A complete gun, ready for tests, exists in this country.

The designer has estimated that in 20 mm. calibre the rate of fire would be 750 rounds a minute and the muzzle velocity 975 m/sec. With a calibre of 24 mm. the rate of fire would be 685 rounds a minute and the speed of the projectile 1,150 m/sec.

AERONAUTICAL RESEARCH IN AUSTRALIA

DR. WIMPERIS'S visit to Australia is now bearing fruit and the aeronautical research facilities which he advocated are being established by the Council for Scientific and Industrial Research in Melbourne. On a site of 14 acres, the administrative block, the mechanical testing and workshop blocks are now complete and the wind tunnel building is in course of construction.

The administrative block is a two-storey brick building housing the general office and senior research staff. It contains also the main library and several laboratories—the instrument, fuel and oil, metallurgic and photographic.

The workshops and mechanical testing laboratory are housed in a steel-framed, fibro-cement building 280ft. long by 40ft. wide. The structures and materials section occupies about half of this building. One bay is taken up with laboratory stores and staff offices, the next with testing equipment, while the third will be used for large-scale structural tests and will also contain the heat-treating equipment of the metallurgy section. Universal and other testing machines will be installed in the second bay when delivered.

The first two bays have been heat insulated with "Turnal" (a thin asbestos sheeting coated with aluminium foil) in an attempt to limit the change in temperature and have been rendered as near dust proof as practicable by sealing up all the joints and by laying a resilient magnesite composition floor called "Linotol."

This building also includes the workshops as mentioned above. The general engineering workshop and the wood-working shop are separate and are both fitted with a very complete range of modern machine tools. It is expected that the workshop will be capable of making most of the special apparatus, models and equipment likely to be needed by the laboratories.

The wind tunnel, which is of the closed-circuit type with an octagonal working section 9ft. × 7ft., is of steel and is being built in Melbourne. The motor and fan are being constructed in England, but the balance is to be made locally. The whole unit should be operating in about six months' time.

The building to house the large engine test plant, which is capable of taking units up to 2,000 h.p., has not yet been started as the equipment will not be available for over a year. In the meantime, several small engine dynamometers and single-cylinder units will be installed in the last bay of the workshop block.

The senior staff consists of: Mr. L. P. Coombes (Officer-in-Charge); Mr. H. A. Wills (Structures and Materials Section); Dr. M. W. Woods (Engine Section); and Dr. G. N. Patterson (Aerodynamics Section).

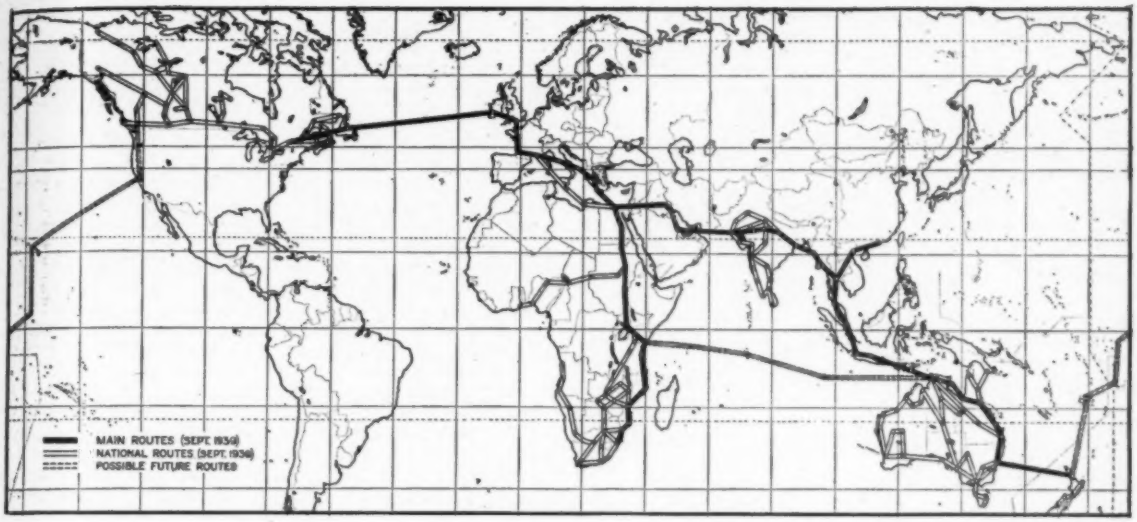


Fig. 1. Air routes of the British Empire.

LOOKING FORWARD

Prolegomena for a Detailed Study of the Future of British Civil Aviation : The Wilbur Wright Memorial Lecture of the Royal Aeronautical Society

By H. ROXBEE COX, Ph.D., D.I.C., B.Sc., F.R.Ae.S., A.F.I.Ae.S.

ON May 30, 1940, at the Institute of Electrical Engineers, London, the 28th Wilbur Wright Memorial Lecture was delivered by Dr. H. Roxbee Cox to an audience which included many distinguished aeronautical personalities. Many others were prevented from attending by the increased national productive effort which is falling very heavily on the aircraft industry.

In the absence of the President, Mr. A. H. R. Fedden, who was in America and had expressed his intention of spending that day with Wilbur Wright's brother, Orville, Lt. Col. J. T. C. Moore-Brabazon was in the chair. He read the good wishes which had been telegraphed from America by Mr. Fedden and from the Institute of Aeronautical Sciences and the telegram which the Society had sent to Orville Wright. He then explained how the lecture which the audience had gathered together to hear was intended to keep evergreen the memory of Wilbur Wright who, with his brother, was responsible for the first controlled and sustained flight on December 17, 1903. He noticed among the audience many who knew Wilbur well, and he counted himself fortunate to be among those who had been friends of this great man. Wilbur, he said, was a superman, a man of extraordinary interest, yet nevertheless of great simplicity of character and few words—a friend to be loved and honoured.

One could not stress the idealism of the Wright brothers too much. Mechanical science has rushed forward so swiftly that it has outstripped the wisdom of man, and the lengths to which the prostitution of science to military ends has been carried would be a shock to Wilbur Wright could he come back to-day.

He then called upon Dr. Cox to deliver the lecture and said that, following the distinguished names which we had had in the past on these occasions, there now stepped forward another who was young, clever and ornamental. His career following his scientific education at Imperial College led him to the Austin works during 1918-20, after which he was a designer at the Royal Airship Works and then a principal scientific officer at Farnborough and visiting lecturer at Imperial College. Until the war he was chief technical officer of the Air Registration Board, but at present was engaged on war work.

Dr. Cox then read some of the more important parts of his paper, and hereunder, and in subsequent issues, follows a précis of this document:

The list of the Wilbur Wright lecturers is a long and distinguished one, and I feel it a great honour to have been asked to join this eminent company, because no greater compliment can be paid an aeronautical engineer.

There can be no doubt that when a country is fighting for its life, its primary aim is to win the fight, but it is generally agreed that we are fighting also for our civilisation. It would seem axiomatic, then, that we must preserve the means of civilisation, of which civil aviation is one. British civil aviation at the outbreak of war was at the beginning of a struggle to make for itself a position in world aviation worthy of the Empire. Unless the struggle is sustained we shall find at the end of the war that our position in relation to our greatest rivals is desperately, if not irretrievably, inferior.

Plans would have been made for the furthering of British civil aviation had the war not happened, and plans—more modest plans, perhaps—must still be made. In other fields great efforts are being made that our instruments of commerce and communication may remain unimpaired. It is my conviction that our air communications also should proceed as closely as may be possible along the lines of their peacetime development.

The Committee Period

This Wilbur Wright lecture is in two respects unusual. Whereas previous lectures have generally been reviews of contemporary knowledge, this one ventures on to the dangerous ground of the future; the tradition that the lecture is not debated is in consequence doubly welcome. In the second place, it is unusual that the lecture should have a chiefly domestic appeal, but I should like my American friends to know that, however dull they may find it, it is no whit less sincere a tribute than its predecessors to Wilbur Wright.

LOOKING FORWARD (CONTINUED)

The story of British civil aviation in the years preceding the outbreak of hostilities is punctuated by reports of committees set up by the Government to enquire into various aspects of civil aviation. Their most important recommendations were accepted, and some of these were so important that they defined the basis on which the future was to be built.

The first of these was the Gorell Committee, which recommended in 1934 that "the control of airworthiness of civil aircraft should be devolved from the Air Ministry" to an executive authority, which was established in 1937 and known as the Air Registration Board. It has control over aircraft up to 10,000lb. and carrying 10 passengers.

The Maybury Committee reported in 1936 that internal airlines could be made to pay if competition were restricted, and made a recommendation which was subsequently implemented that an Air Transport Licensing Authority be established.

The third Committee under Lord Cadman made a comprehensive and far-reaching review of British civil aviation in 1938 and they viewed "with extreme disquiet" the position revealed to them. "In our view," they said, "the problem of the air is one—two sides of a single coin—and the military aspect of aviation cannot fundamentally be separated from the civil aspect." The phrase rather suggests that the characteristic of the coin significant in the simile is the proximity of its sides, but the committee's subsequent development of the theme suggests that they also appreciated the fact that the two sides face in opposite directions. The indisputable facts are that

civil and military aeroplanes are designed for diametrically opposite purposes, peace and war,

the scientific and technical problems raised by civil and military requirements are often the same.

These facts suggest that the directions of civil and military aviation should, like the directions of mercantile and naval marine, be in different hands, but that these directorates must be co-ordinated to avoid duplication of research. To emphasise this by an obvious example, the economics of air transport and the efficiency of fighters require very different training and experience for their attainments, but both demand the reduction of aerodynamic drag to a minimum—a single scientific problem.

The Cadman recommendations called for the strengthening of the civil aviation staff of the Air Ministry, the expansion of British air routes, the use of British aircraft on them, and the increased subsidisation of civil aviation. This last was done by the increase of the annual subsidy from £1½ to £3 million, and the British Overseas Airways Corporation was formed by amalgamation.

The last of the committees, with Mr. Harold Brown as chairman, reported in April, 1939, on "how best to improve co-ordination between aircraft constructors, airline operators and the Air Ministry in the production of civil air liners." The committee summarised the various bodies concerned with aeronautical research and development work here—the Air Ministry, the Aerodynamics Department of the National Physical Laboratory, the Air Registration Board, the Aeronautical Research Committee, the technical staffs of firms and certain University workers—and concluded that almost the whole effort of these bodies was directed primarily to problems of military aviation. The committee, not surprisingly, found this state of affairs most unsatisfactory. In comparison with the organisation of the Civil Aeronautics Authority in the United States, it must have appeared little short of tragic to them.

They concluded that British civil aviation would stand a chance of occupying a leading position in world civil aviation only if large sums of public money were spent on it. Assuming the money to be forthcoming, the Brown Committee suggested that the co-ordination they regarded as essential could best be provided by an advisory committee called the Civil Aviation Development Committee. By the beginning of the war, the Government had made some progress in the appointment of this committee, but what their plans for financial assistance were had not been disclosed.

The Initial War Period

The work of the committees produced the Air Registration Board, the Directorate of Civil Research and Production of the Air Ministry, the Air Transport Licensing Authority, and the British Overseas Airways Corporation. Of these, the Board continues with a reduced staff to look after the technical needs of the war-withered body of civil aviation; the Directorate has ceased to exist, and its vigorous Director is directing something else; the Authority has also gone; but the Corporation, though beset with difficulties, is very much alive and, I am glad to see, kicking.

Summarising the reports of the Committees, they reveal

the realisation that civil aviation cannot be self-supporting,

the belief that to give British civil aviation its proper place in the world, large expenditure of public money (which would, however, look trivial when compared with war expenditure) is necessary,

a tendency to separate the governance of civil from that of military aviation,

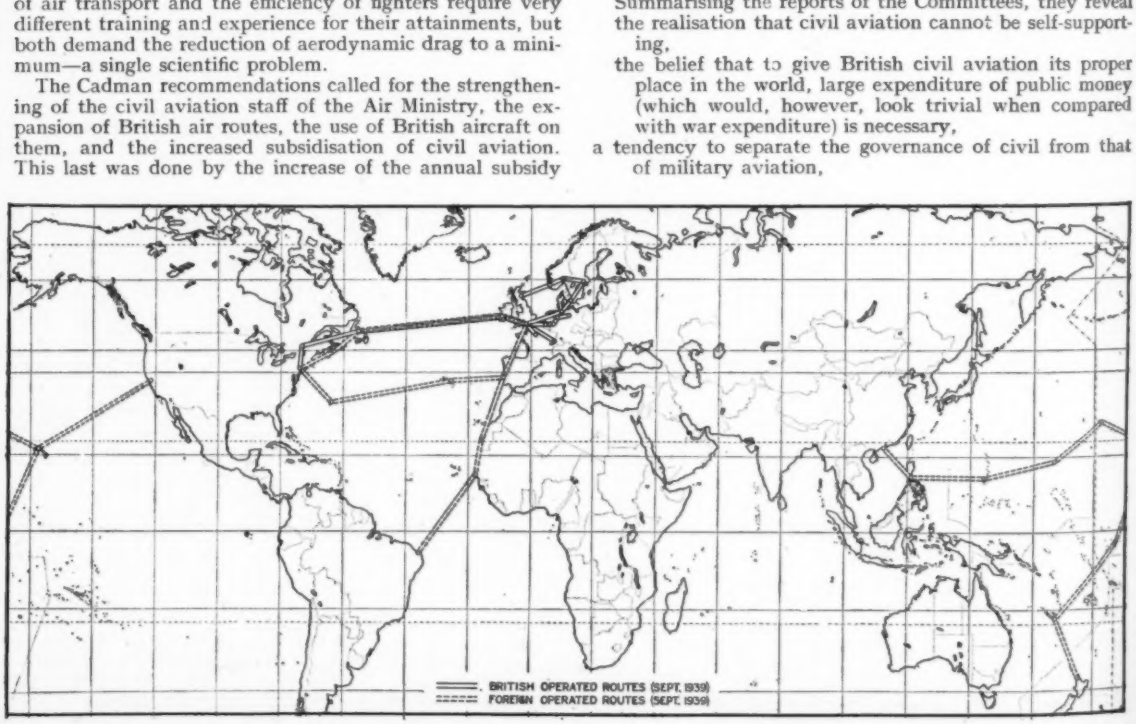


Fig. 2. Principal air routes joining the Empire and other countries.

LOOKING FORWARD (CONTINUED)

the need for the civil aviation industry to take part in its own control,

an appreciation of the need for co-ordination and collaboration.

My discussion of future developments will assume the persistence of these ideas.

There is little doubt that, had the war not intervened, these developments would have been directed by the Civil Aviation Development Committee, the Cadman and Brown Committees having made clear the need for a renaissance. If and when that Committee is formed, its task, already gigantic, will be still more formidable, for in the few months since the war started, the position of British civil aviation has seriously worsened. The Secretary of State has, however, announced his intention "to set up a strong Civil Aviation Advisory Committee to keep under review the position of civil aviation in the light of the present situation and to plan for the future." He proposed as the second step that "this committee should have associated with it a small body of experts whose task it would be to keep in touch with all phases of technical development in the field of civil aviation abroad."

I assume that we want British civil aviation to be a great and successful enterprise. We want it to stand as a symbol for safety, for comfort, for speed, and for consistency. These are admirable but vague objectives. How can we be more precise?

The Aims of British Civil Aviation

For communications within the Empire the routes should be British and the aircraft on them should be British. Of the routes communicating with the rest of the world, it would appear just that half should be British, with British aircraft operating on them. It is worth while discovering how far we have got towards this goal. The Imperial routes are already extensive (see Fig. 1) and the total route mileage is impressive, though the traffic is not large.

TABLE I
ROUTE MILEAGES AND PASSENGER TRAFFIC OF LEADING COUNTRIES

Country	Year	Route Mileage	Passenger Miles Flown	Density of Traffic. Passenger Miles per Mile of Route
British Empire ...	1938	89,077	127,725,699	1,435
U.S.A.	1938	71,199	554,239,196	7,650
France	1938	40,833	38,847,041	950
Germany ...	1937	30,490	74,924,405	2,460
U.S.S.R.	1937	58,036	55,506,942	955

The main lines joining the Empire to the rest of the world are given in Table II and Fig. 2. The Empire had a half-share in the first route, had none in the second, operated her half of the third largely with foreign aircraft, and had no share in the rest. So far the Empire main routes are purely British. But four years ago most of the national lines and the British-operated Continental lines were. The danger grows. And if ever foreign bodies get into the main arteries, our Empire routes, we may as well start to write the obituary of British civil aviation.

TABLE II
MAIN ROUTES JOINING THE BRITISH EMPIRE TO THE REST OF THE WORLD PRIOR TO SEPTEMBER, 1939

Countries joined	Airports used	Route normally operated by
Great Britain - U.S.A.	Southampton - Foynes - Botwood - Montreal-New York.	Great Britain. U.S.A.
Great Britain - U.S.A.	Southampton - Lisbon - Azores - New York.	U.S.A.
Great Britain-Europe	Various	Great Britain and European countries.
Africa-South America	Dakar-Port Natal	France. Germany.
U.S.A.-Hong-Kong ...	San Francisco-Honolulu-Hong Kong.	U.S.A.
U.S.A.-Australasia ...	San Francisco-Honolulu-Auckland	U.S.A.

There are, then, 84,600 miles of airline in the Empire. There are 27,600 miles connecting it with the rest of the world. All of the first lot and half of the second should be British-controlled and operated by British aircraft, a total of 98,400. That should be one of our aims. There are routes still to be opened up, perhaps 12,000 miles in the Empire. We must see to it that these are all-British.

There are countries with air routes, and countries needing air routes, with no national aircraft industries. We must study their conditions and compete with the other great exporters of civil aircraft for the markets.

It will be of no use to extend our routes unless we operate the most modern aircraft and equip them with the latest navigation and landing devices. We shall not produce these modern aircraft without unremitting research, invention and development. We shall not be able to maintain our standards of safety without accurate weather forecasting and up-to-date regulation and control. None of these activities will be possible without a sane and generous financial scheme.

The Controlling Authority

The main constituents of civil aviation are shown in Table III. Their co-ordination and direction along the path of progress and efficiency is the business of the controlling authority. The suitability of the Air Ministry for the task has often been questioned, mainly on the grounds that the Ministry's primary concern is the Royal Air Force and that in consequence the needs of civil aviation are always likely to be subordinated. The Government have resisted this view in the past, emphasising the common interests of military and civil aviation.

TABLE III
THE MAIN CONSTITUENTS OF CIVIL AVIATION

Constituent	Details	Responsibility chiefly with
Operation ...	Airline management. Development of aerodromes and routes. Radio communication. Licensing of routes.	Operating companies. Controlling authority.
Design and construction.	Production of material—airframes, engines, instruments and equipment.	Constructing firms.
Research and development.	Theoretical and experimental investigations.	Experimental establishments of the State. Operating companies. Constructing firms. Universities.
Regulation and safety.	Codification of rules for safe flight. Certification of aircraft. International agreements.	Controlling authority.
Accident investigation.	——	Controlling authority.
Education and training.	Education of engineers and scientists, training of pilots, navigators and ground engineers.	Controlling authority. Universities. Technical colleges. Operating companies. Constructing firms. Royal Aeronautical Society.
Finance ...	General and airmail subsidies. Insurance.	Controlling authority. City.

Those who would prefer civil aviation to be separated from the Air Ministry point to the mercantile marine which is in peacetime controlled by the Board of Trade and not by the Admiralty. Some of these separationists would prefer to see civil aviation under the Board of Trade, others would prefer the Ministry of Transport; some would like to see civil aviation with a ministry of its own. This last arrangement has been found the most convenient in the United States, where the control of civil aviation was removed from the Department of Commerce and placed in the hands of the Civil Aeronautics Authority, a council of five men responsible directly to the State and employing large administrative, technical and executive staffs.

The Government's last published word on this question was in 1934 when they had "no intention of changing a

LOOKING FORWARD (CONTINUED)

basis of air organisation which has been so successful that it has since been adopted by foreign nations . . ." The success of the organisation since then has not been so marked as to prevent the Civil Aviation Advisory Committee weighing the advantages and disadvantages of other possible arrangements just mentioned. That this matter should receive careful consideration cannot be doubted, as the decision will be of primary importance. But whoever controls civil aviation, the task before it, war or no war, will be the one I have already defined. The authority must be the originator and elaborator of policy, both a fount and an irrigator of initiative; it must control and co-ordinate the activities of the specialist staffs, correlating them with the activities of the aviation industry.

Operation

One assumes that in the future the design of a civil airliner will generally be in direct response to a set of requirements laid down by the operator to meet the conditions of a particular route. At present the regulation minimum safety requirements are invariant with route. Now, it can clearly be argued that, providing it is strong enough, an aeroplane should be allowed to carry more when flying over cool, flat country between large sea-level aerodromes than when flying over mountains between high up aerodromes in the tropics. If it is argued, on the contrary, that the minimum safety requirements are so chosen as to make the aeroplane safe under both sets of conditions, then they are obviously uneconomic under the most usual conditions of operation. I submit that the minimum safety requirements should vary with route conditions.

It is scarcely necessary to mention the certain call for greater speed and greater size. One stage less obvious is greater comfort. In dealing with this we must remember that the necessity for comfort-giving things becomes less as trip time decreases and the time spent in bed increases. This suggests flying fast by night, leaving the day free for work. Unfortunately, beds take up more room than chairs and the answer will only be clear after study of economics, statistics, and passenger psychology.

I very much doubt whether there is any simple answer to the question of whether passengers and mails should be segregated, but I would venture the opinion, however, that on some routes we shall need the pure mail plane.

The Atlantic Route

Let us first consider the Atlantic crossing which, from Southampton to New York, is approximately 3,400 miles. Sea travellers take five days on the journey, in supreme comfort. At what speed should air transport operate?

The present transatlantic performance by Pan-American corresponds to a west to east ground speed of about 170 m.p.h. and an east to west ground speed of about 130 m.p.h., as west winds up to 40 m.p.h. are always to be expected. Except under very unusual conditions, the greatest cruising speed required is 170 m.p.h. The effective time (difference of local standard times) is 29½ hours for eastbound and 24 hours for westbound trips, in the latter case a loss of only one working day in travelling. To achieve this in the opposite direction requires that the cruising air speed be raised to 235 m.p.h.

After this the obvious big step forward would be to make the journey overnight. That we cannot at present consider this is clear from the calculation which shows that, though a westbound speed of 240 m.p.h. would be adequate, an eastbound speed of 486 m.p.h. would be required. But an approximation to the overnight ideal is possible at 300 m.p.h. This would allow arrival at Southampton at 10 hours if departure had been made from Montreal at 06 hours the previous day. I suggest, then, that the next big advance in operational speed will be to 300 m.p.h., though I gather that Dr. Warner is not optimistic of this being achieved.

What degree of comfort should be supplied at this speed? The westbound passengers will be on board only 13, the eastbound only 11 hours, and most of this time may be spent in bed. I suggest that weight and space might be more profitably expended in comfortable beds than in promenade decks and wine cellars.

Passenger comfort, as well as general safety, will urge the aeroplane as high as possible to avoid bad weather. It is important to make certain whether, for a really large craft with, probably, an airship-like indifference to gusts, this urge need be taken seriously. On the answer depends whether the pressure cabin and its attendant complication is necessary. Weather statistics are incomplete, but suggest an operating height in excess of 15,000 feet.

The designer will need a figure for still-air range. This decreases with increase of speed, as the effect of head wind then becomes smaller. For a cruising speed of 300 m.p.h., allowing an abnormal head wind of 50 m.p.h. and 25 per cent. for deviations from the route to avoid even worse conditions, we get approximately 5,000 miles.

The most difficult problem is the estimation of capacity. In ordinary times there are about 1,000 first-class passengers and 70,000 lb. of first-class mail (nearly half of which is from or to Great Britain) travelling between Europe and North America each way per week. With the possibility of American, French, German and British airlines competing, and supposing that some people will prefer to go by sea, it will probably not be necessary for some time to come to cater for more than 250 passengers and 20,000 lb. of mail per week each way. This is a probable maximum, and to deal with it, if one aeroplane went each way every day, each would have to carry on an average 35 passengers and 3,000 lb. of mail. To deal with fluctuations in load, the aircraft would probably need to have room for 50 passengers.

Whether the mail should go separately and whether a 90-passenger aircraft every two days is preferable to a 50-passenger craft every day are questions which will have to be decided. I urge the construction of a 300 m.p.h. overnight mail plane. It would be relatively easy to make and the experience with it would be invaluable for the 300 m.p.h. passenger craft. Three possible schemes which are goals to aim at are given by combinations of the services given in Table IV. These combinations are: either A alone; B, D and E together; or C, D and E.

TABLE IV

POSSIBLE OVERNIGHT NORTH ATLANTIC SERVICES

Service	Cruising Speed (m.p.h.)	Still Air Range (Miles)	Passenger and Mail Capacity
A. One passenger and mail aeroplane each way each night between Southampton and Montreal or New York	300	5,000	50 3,000 lb.
B. One passenger aeroplane each way each night between Southampton and Montreal or New York ...	300	5,000	50
C. One passenger aeroplane each way every other night between Southampton and Montreal or New York	300	5,000	90
D. One mail aeroplane each way each night between Southampton and Montreal	≮ 300	5,000	1,500 lb.
E. One mail aeroplane each way each night between Southampton and New York	≮ 300	5,000	1,500 lb.

We shall not expect to reach one of these desirable arrangements without a transition period. When the first of the new craft go into service, the old ones will still be working. We may for a time see a first-class non-stop service and a second-class service stopping at Foynes and Botwood. It might be worth while to plan with this in view.

There are two important aspects of the North Atlantic service which I have not mentioned. The first is that at present, unlike the Azores route, it is a summer service. To be taken seriously it will have to be an all-the-year-

round one There is, therefore, ahead of the operators a highly interesting and perhaps exciting period.

Secondly, are we in future designs to assume dependence on refuelling in the air or any other means of assisting heavily loaded aeroplanes to take off? At present refuelling is a most valuable adjunct to British transatlantic flying; it has been most skilfully developed and is capable of further development. But while I have no doubt about its value now and in the immediate future we cannot uncritically assume that it has come to stay. The matter needs a most careful analysis. On the one hand, it is a means of enormously increasing the range of an aeroplane at practically no expense in performance; its potentialities in this direction have been put forward by Mr. Langley with considerable restraint and are still impressive. On the other hand, it requires equipment and organisation and bad weather may hinder it. The question is an economic one—smaller aeroplanes and refuelling versus larger "self-contained" aeroplanes. The outcome of this debate will have a considerable influence on transatlantic design. Apart from the methods of reducing ground friction, the other possible means of assisting take-off seem to be inapplicable to really large passenger aircraft, and it is doubtful whether they are economically applicable to the smaller mail plane.

The Route to the East

The Golden Road to Samarkand had no more romantic appeal and no greater importance than the great airway to the East. It is the greatest high road the world has seen; Air France use it to reach Indo-China; K.L.M. use it to reach the Dutch East Indies; and we go farther along it still to reach Australia. At Alexandria it joins with the trans-Africa route to Durban.

The present speed along these routes is disappointing. Even so, the improvement on other means of transport is impressive; the journey to Australia takes 10 days by air compared with six weeks by sea. The fact that in 1932 the K.L.M. Douglas DC2 flew to Melbourne in the Mac-Robertson race in 2 days 23½ hours suggests that considerable improvement is possible. The flying time to Sydney is less than 100 hours and a tremendous saving would be possible if the route and aircraft were designed for night flying. At present speeds, passengers would still have to live on board for about five days.

But we should aim for something better. At present the route to Sydney has 36 stages varying between 533 and 170 miles. I put forward the idea of a fast service joining the main constituents of the Empire, with a service such as the present one acting as a feeder line all along the route. The fast service might be Southampton-Alexandria (2,563 miles), Alexandria-Karachi (2,655), Karachi-Singapore (3,433), Singapore-Darwin (2,319). On more direct courses these stages might be roughly 2,200, 2,100, 2,700, and 1,800 miles. With an aeroplane comparable in performance with that for the transatlantic service, the journey could be done in about 30 hours' flying time.

I hope others may be sufficiently interested in this idea to work it out in detail. It suggests a possible two-day trip between Southampton and Darwin. On the trans-Africa route corresponding improvements appear to be possible. The aircraft used would need a greater degree of luxury than the transatlantic craft. Besides providing ample space and entertainment for the passengers, it would have to keep them safe and comfortable in a variety of climatic conditions.

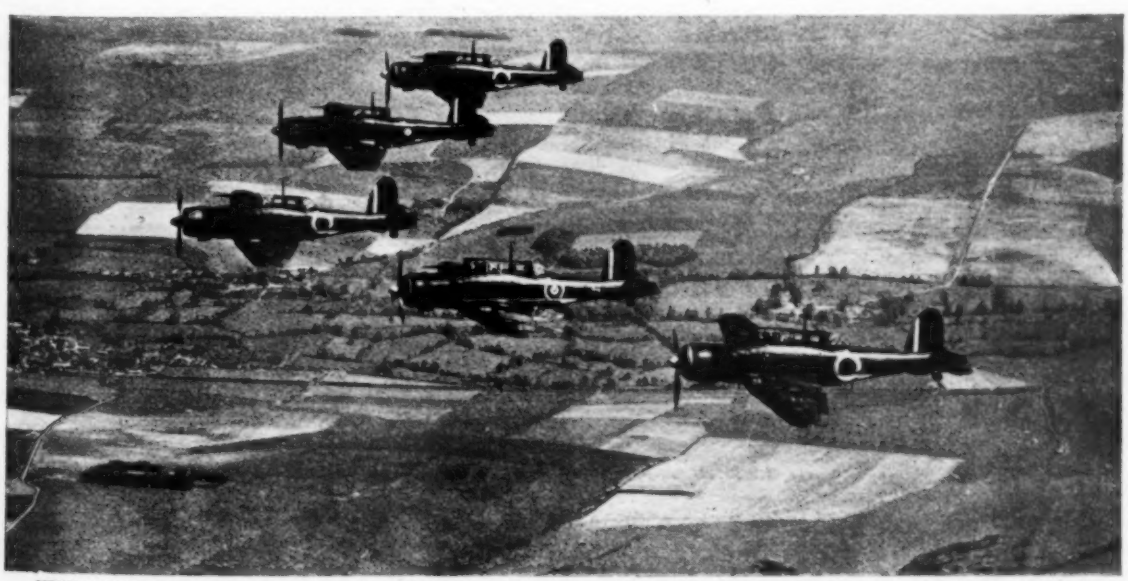
European and Internal Routes

The main characteristic of the European services from London must always be their high frequency. The intense competition between the European countries will ensure the continual elevation of operating speed. The frequency would seem to make the appearance of really large aircraft unlikely, and one visualises the use of short range aeroplanes providing day and sleeper accommodation. Night travel and night mail services are also obvious developments.

Conceivably the special conditions of the short London-Paris route may produce a specialised type. It is possible that the volume and type of traffic may grow to dimensions demanding ferries of great seating, perhaps even strap-hanging, capacity. If such a service could be run at cheap rates it might set a fashion in international transport with inestimable benefits to European peoples.

It would be idle to pretend that there is great scope for internal air lines in Great Britain. The distances between aerodromes and towns so often make the effective speeds of air travel less than that of trains and automobiles, but there must be room for a highly organised service based on the Maybury plan. The requirements would be regular night operation, a high-speed civic-centre-to-aerodrome service, and a fast, small transport aeroplane. The chief virtue of all internal services is frequency. For all routes in Great Britain, therefore, we may expect to use relatively small aircraft for some time to come. I feel that we could use a fast ten-seater and a fast five-seater. I visualise these as all-metal aircraft with cruising speeds not less than 200 m.p.h. and such aircraft should find a ready market elsewhere.

(To be continued next week.)



NEW NAVAL UNIFORMS: A formation of Blackburn Skua naval fighter dive-bombers showing the vertical red, white and blue stripes on the fin. The vertical tail markings were officially abandoned some years ago as they interfered with the mass balancing of the rudder; it may not have occurred to anyone at the time to place them on the fin.

SERVICE AVIATION

Royal Air Force — *Official Announcements*

The King's Visit

THE King has recently made a two-days' tour of R.A.F. stations in England. He visited many units and talked to officers and men of bomber and fighter aircraft which have been engaged against the enemy. At one Bomber Command station he decorated officers and men in a hangar. The recipients were:—DISTINGUISHED FLYING CROSS: A/Flt. Lt. G. T. B. Clayton, P/O. R. J. Hill, F/O. G. B. Warner, Sqn. Ldr. W. P. Sutcliffe and F/O. G. O. Lings. DISTINGUISHED FLYING MEDAL: A/C. 1 J. H. Waterfall, Sgt. W. G. Brinn and Sgt. R. F. Wyness.

More Canadians

A FURTHER contingent of the Royal Canadian Air Force have now arrived in this country. The commanding officer, a Bristol Fighter pilot of the last war, spoke of the eagerness of his officers and men to get busy in the war.

Awards

THE King has approved the following award in recognition of gallantry displayed in flying operations against the enemy:—

DISTINGUISHED SERVICE ORDER.

DONALDSON, SQUADRON LEADER EDWARD MORTLOCK.

Sqn. Ldr. Donaldson has inspired in his squadron such a fine fighting spirit that, on his first encounter with enemy forces, nine aircraft of his squadron destroyed six enemy aircraft, and a further five were believed to have been destroyed. Four or five enemy aircraft were accounted for on the following day. This officer's high courage and his inspiring qualities of leadership have made his squadron a formidable fighting unit. He has, himself, shot down four enemy aircraft.

APPOINTED COMPANIONS OF THE DISTINGUISHED SERVICE ORDER.

DEWAR, SQUADRON LEADER JOHN SCATLIFF, D.F.C.

Before intensive operations started this officer injured his right shoulder in a severe flying accident. Despite this, he flew regularly and led his squadron with skill and dash, more than 60 enemy aircraft being destroyed by them. He remained in command of the squadron throughout the operations, in spite of the injured shoulder, trained his new pilots well and continued throughout to be a very efficient commander, inculcating an excellent spirit in his squadron.

OLIVER, SQUADRON LEADER JOHN OLIVER WILLIAM, D.F.C.

This officer commanded a squadron in France until he was invalided to England on May 19th, 1940. The small losses in his squadron were directly due to his leadership and instruction. Over fifty enemy aircraft have been brought down by the squadron, of which Sqn. Ldr. Oliver himself accounted for at least eight. Although ill from the effects of Glycol when his engine was damaged, he did not allow his condition to handicap his flying or his administration. He was an incomparable fighter commander and his personal example in the air and on the ground was a very great inspiration to his pilots. It was, in fact, necessary to restrain him from flying again after his aircraft had been shot down and he had landed by parachute.

KAYLL, ACTING SQUADRON LEADER JOSEPH ROBERT, D.F.C.

Owing to his inspiring training and leadership this officer's squadron has destroyed 32 enemy aircraft. The squadron responded to every call made and, in particular, made several important and dangerous reconnaissances for the Army. Sqn. Ldr. Kayll combined flying leadership and administration in an exemplary manner throughout, and destroyed five enemy aircraft, bringing his total to nine.

CHURCHILL, FLIGHT LIEUTENANT WALTER MYERS, D.F.C.

Flt. Lt. Churchill assumed command of a squadron shortly after its arrival in France and led it with marked success, inspiring his pilots and maintenance crews magnificently. He undertook the tactical instruction of new pilots, led many patrols successfully and organised his ground defences and crews in an exemplary manner. While under his command, the squadron destroyed 62 enemy aircraft and he was throughout the mainspring of their offensive spirit, their excellent tactics and their adequate maintenance results. Only four pilots of the squadron were lost. Flt. Lt. Churchill destroyed 4 enemy aircraft, bringing his total to 7.

LEE, FLIGHT LIEUTENANT RICHARD HUGH ANTHONY, D.F.C.

This officer has displayed great ability as a leader and intense desire to engage the enemy. On one occasion he continued to attack an enemy aircraft after his companion had been shot down, and his own machine hit in many places. His section shot down a Junkers 215 in flames one evening in May, and another in the course of an engagement the next day. In his last engagement he was seen at 200 feet on the tail of a Junkers 89, being subjected to intense fire from the ground over enemy occupied territory. This officer escaped from behind the German lines after being arrested and upheld the highest traditions of the service.

DISTINGUISHED FLYING CROSS.

DICKENS, WING COMMANDER LOUIS WALTER, A.F.C.

This officer led nine Blenheim aircraft in an exceedingly determined and gallant attack which he succeeded in pressing home with success in the face of extremely heavy enemy opposition. While no exact estimate can be given as to the number of enemy fighters in contact, a formation of nine Messerschmitt 109's and four Messerschmitt 110's attacking the leading formation were identified, and the remaining two sections were simultaneously heavily engaged by a superior number of Messerschmitt 110's. The attack was of great moment and the courage and leadership displayed by this officer inspired the squadron in an operation which otherwise might have completely failed.

DEWAR, SQUADRON LEADER JOHN SCATLIFF.

This officer has shot down five enemy aircraft and led many patrols with courage and skill.

OLIVER, SQUADRON LEADER JOHN OLIVER WILLIAM.

This officer commanded his squadron extremely well and has led two escort formations of 24 aircraft each to a distance of 140 miles from their base. During these escorts the formations accounted for more than a dozen enemy aircraft. In addition, in May, 1940, he shot down an enemy aircraft which crashed at Hazebrouck and he has led his section magnificently on many occasions. His sangfroid and calm outlook have encouraged his squadron to a remarkable degree and the spirit of his squadron and his leadership is reflected in the successes of his squadron.

LOWE, ACTING SQUADRON LEADER GEOFFREY.

On a night in May, 1940, this officer led a formation of aircraft in an attack on an objective near Hamburg. In spite of strong opposition from enemy fighters and anti-aircraft defences, and considerable difficulties caused by searchlights, he pressed home his attack and secured two direct hits, which caused fires and explosions on the target. These fires enabled the remaining aircraft to locate and hit the target. When attacked by enemy aircraft his skilful manœuvring enabled his rear gunner to get in bursts of fire, causing the enemy to break off the fight.

KAYLL, ACTING SQUADRON LEADER JOSEPH ROBERT.

This officer has shown courage and skill in shooting down four enemy patrols.

BOOTHBY, FLIGHT LIEUTENANT JAMES ROBERT MAITLAND.

Flt. Lt. Boothby has consistently led his section with skill and efficiency. He himself shot down three enemy aircraft in one day.

CHURCHILL, FLIGHT LIEUTENANT WALTER MYERS.

This officer has shot down three enemy aircraft since his arrival in France and has led many patrols with courage and skill.

ROYCE, FLIGHT LIEUTENANT WILLIAM BARRINGTON.

Flt. Lt. Royce assumed command of a squadron after its three previous commanders had been lost. One day in May his squadron had completed seven sorties, including two ground attacks, by 13.00 hours, and were eager to go out yet again. Flt. Lt. Royce shot down four enemy aircraft. He led the squadron in a most efficient and determined manner.

POWELL, FLIGHT LIEUTENANT ROBIN PETER REGINALD.

This officer has displayed outstanding leadership and gallantry. In May, 1940, his flight, although greatly outnumbered, destroyed some six enemy aircraft, and the next day a further four were destroyed. In these engagements Flt. Lt. Powell personally brought down at least one of the enemy aircraft on the first day and two on the second day.

SIMPSON, FLIGHT LIEUTENANT WILLIAM.

In May, 1940, Flt. Lt. Simpson led a half section of aircraft carrying out a low-level bombing attack on troops and convoys on a road between Luxemburg and Junglister, with the object of checking the German advance after the violation of Holland and Belgium. Despite intense anti-aircraft fire after crossing the frontier he pressed home the attack and scored four direct hits on the convoy. After the attack, owing to a leak in the petrol tank, it was necessary to make a forced landing. As the aircraft touched ground

HOME FOR A WASH AND BRUSH UP: The Flying Officer on the left was shot down over Dunkirk after bagging a number of enemy aircraft. He said he was home for a "wash and brush up and another Hurricane."

flames arose from the bomb-aimer's trap. The pilot was only saved by the prompt action of the crew before the aircraft exploded.—Flt. Lt. Simpson has consistently done good work.

DUTTON, ACTING FLIGHT LIEUTENANT ROY GILBERT.

In May, 1940, whilst leading a section of a squadron on patrol over Brussels, Flt. Lt. Dutton attacked and shot down two Heinkel 111 aircraft. The next day, when leading a section of a squadron, seven Messerschmitt fighters were sighted escorting from fifty to seventy enemy bombers. The leader of the formation attacked the bombers, and Flt. Lt. Dutton, realising the danger to the formation, ordered two aircraft of his own section also to attack the bombers whilst he climbed and engaged the Messerschmitts until the attack on the bombers was completed. He then dived away, and flying west sighted and shot down a Heinkel 111 with his remaining ammunition. Flt. Lt. Dutton has displayed initiative, gallantry and a complete disregard for his own safety.

CONNORS, FLYING OFFICER STANLEY DUDLEY PIERCE.

This officer showed outstanding fighting ability and gallantry when, during two consecutive days in May, 1940, whilst greatly outnumbered, he shot down three Heinkel 111s, two Junkers 88s and one Messerschmitt 109.

ALLEN, FLYING OFFICER DEREK HURLSTONE.

F/O. Allen has taken part in all combats with Flt. Lt. R. H. A. Lee, following his section leader with great loyalty. In May, 1940, he took part in shooting down a Junkers, and the next day another enemy aircraft of the same type. On the latter day, after his aircraft had been severely damaged by anti-aircraft fire, he did not hesitate to attack with vigour and determination a Junkers 89 over enemy occupied territory and shoot it down.

ANGUS, FLYING OFFICER ALLAN BENJAMIN.

This officer has shown great determination in taking every opportunity of engaging the enemy and pressing home his attacks. He took part in an inconclusive attack on a Junkers 88 which resulted in serious damage to the enemy aircraft. His own aircraft was hit, and as a result he had to force-land in Belgium. Acting on his own initiative he rejoined the squadron in a few hours. In May, while on patrol, he intercepted and shot down in flames a Heinkel 111, and on the same patrol took part in shooting down a second enemy aircraft of the same type with P/O. David.

BLAIR, FLYING OFFICER KENNETH HUGHES.

F/O. Blair has shown exceptional keenness both before and during the present operations. He has engaged successfully two enemy bomber aircraft: at dawn, one day in May, when he succeeded in being the first off the ground in pursuit of a Heinkel, and at dusk on the same day, when he successfully attacked another Heinkel between Arras and Vitry. He had a very narrow escape when a bomb landed within twenty yards of a room in which he was sleeping. He was badly shaken, but insisted on volunteering and taking part in a patrol over Maastricht, when he engaged two Messerschmitt 109s.

CAMPBELL, FLYING OFFICER JAMES ALEXANDER.

This officer succeeded to the temporary command of a flight just before the German invasion of Holland and Belgium, and during the two following days led it with great courage and determination. He set a fine example by destroying four enemy aircraft. On one occasion, when leading a flight of seven aircraft in protection of Blenheim bombers, he showed great personal gallantry in leading his squadron to an attack against forty enemy aircraft.

CARTER, FLYING OFFICER MARK MEDLEY.

In May, 1940, F/O. Carter led his flight against 60 Junkers 87s, of which 11 were destroyed.

CYLDE, FLYING OFFICER WILLIAM PANCOAST.

This officer was posted to France early in May, 1940, and led his flight on many occasions with great skill and has set a high standard of morale and leadership.

GORE, FLYING OFFICER WILLIAM ERNEST.

F/O. Gore whilst leading his section in May, 1940, on a dawn patrol, intercepted a formation of three enemy Heinkel 111 aircraft. Due to his good leadership a determined attack was delivered with the result that all three enemy aircraft were shot down. F/O. Gore's aircraft burst into flames immediately after the attack, but in spite of this he escaped successfully by parachute. This officer has for a long period shown great keenness and devotion to duty, deserving of the greatest praise.

STONE, FLYING OFFICER CEDRIC ARTHUR CUTHBERT.

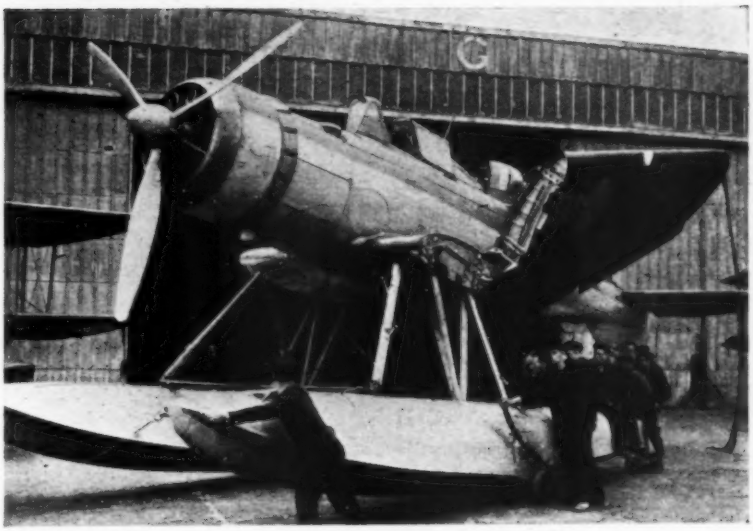
Early in the operations in May, this officer destroyed three enemy aircraft and led his section with great courage and determination.

BLOM, FLYING OFFICER WALTER MICHAEL.

Earlier this month F/O. Blom was detailed to lead a half section of aircraft in a low-level bombing attack against an enemy motorised column of all arms advancing on a road in Luxemburg. Before reaching his objective a petrol tank was pierced by machine gun fire and, although unable to locate his allotted target through being drenched and almost blinded by the escaping petrol, he pressed home his attack on another enemy column with considerable success. During this time the aircraft was subjected to very heavy fire from the ground and was repeatedly hit, receiving such damage as to render it beyond repair, but this did not prevent F/O. Blom from flying back to the base, a distance of 90 miles. He displayed outstanding courage and tenacity.

ALLITT, PILOT OFFICER ROBERT EDWARD.

On a night in May, 1940, this officer was acting as second pilot and bomb-aimer in an aircraft engaged in attacking a target in Germany when the aircraft was severely damaged by gun fire. Although the rudder controls were shot away, and the pilot barely able to control the aircraft, the attack was continued and the bomb-aimer released his bombs on the target. The aircraft received at least five more hits from anti-aircraft fire and one engine was stopped, but, in spite of the aircraft being almost unmanageable, P/O. Allitt succeeded in navigating it under most harassing conditions to the nearest position on the French frontier, a distance of over 100 miles, where the crew were able to abandon the aircraft in friendly country. He displayed conspicuous gallantry and devotion to duty throughout.



THE ROC FLOATPLANE: Pushing out a Blackburn Roc floatplane (Bristol Perseus engine) for a training flight at a Fleet Air Arm base. The Roc has a four-gun Boulton Paul turret.

CAREY, PILOT OFFICER FREDERICK.

This officer destroyed five enemy aircraft early in the operations in May, 1940, and by his dash and courage set the highest example of gallantry to the squadron.

DAVID, PILOT OFFICER WILLIAM DENNIS.

P/O. David has recently shot down four enemy aircraft and shown gallantry and devotion to duty compatible with the highest traditions of the service. His coolness and determination have been a very fine example to the other pilots of the squadron. He was involved in an engagement when six other aircraft of the squadron attacked over 40 German aircraft in an attempt to protect Blenheim aircraft. He backed his leader with great courage and determination, shooting down two enemy aircraft.

STEPHENS, PILOT OFFICER MAURICE MICHAEL.

This officer destroyed four enemy aircraft in May, 1940, and led his flight with courage and skill.

CORBET, PILOT OFFICER WALTER HENRY.

This officer was engaged in May on a bombing attack on enemy convoys when his aircraft was severely damaged by enemy gunfire. He was badly wounded in the foot and his observer was killed. In spite of his weakened condition he succeeded in flying back to his base and saving the air gunner and the aircraft.

DAVY, PILOT OFFICER THOMAS DANIEL HUMPHREY.

P/O. Davy was engaged in a bombing attack on bridges over the Albert Canal. In the face of intense machine gun and light anti-aircraft fire the bridges were bombed, but the result could not be observed. After delivering a dive bombing attack on the target, P/O. Davy's aircraft was attacked by a Messerschmitt 109. The attack was broken off when smoke appeared to be emerging from the enemy. The port petrol tank on his own aircraft was thought to be on fire and P/O. Davy gave orders for the crew to jump clear, but he himself continued his flight for the base until compelled to make a forced landing about eight kilometres away.

WING COMMANDER GEORGE HOLROYD MILLS.
SQUADRON LEADER JOSCELYNE FORGAN HOUSSEMAYNE DU BOULAY.
SQUADRON LEADER LANCELOT ELWORTHY JARMAN.
SQUADRON LEADER CHARLES GEORGE LOTT.
SQUADRON LEADER RICHARD ANGUS MCMURTRIE.
ACTING SQUADRON LEADER ANTHONY ORLANDO BRIDGMAN.
ACTING SQUADRON LEADER RICHARD DOUGLAS STUBBS.
FLIGHT LIEUTENANT PETER ALEXANDER GILCHRIST.
FLIGHT LIEUTENANT ERNEST LESLIE HYDE.
FLIGHT LIEUTENANT ROBERT HAY STEWART MCCONNELL.
FLIGHT LIEUTENANT CLIFFORD FREDERICK CECIL WRIGHT.
ACTING FLIGHT LIEUTENANT ALEC EDWARD PRINGLE.
FLYING OFFICER JOHN PHILIP DYER.
FLYING OFFICER GORONWY EDWARDS.
PILOT OFFICER ERNEST WILLIAM TACON.
FLYING OFFICER CHARLES JOHN FRENCH KYDD.
ACTING FLIGHT LIEUTENANT ERIC CLIVE LE MESURIER.
FLYING OFFICER DAVID CECIL MCKINLEY.
FLYING OFFICER WILLIAM HENRY NELSON.
FLYING OFFICER ELLIS HENRY ROSS.
PILOT OFFICER RICHARD HENRY BUNKER.
FLYING OFFICER PETER ROBERT BURTON-GYLES.
PILOT OFFICER HENRY GEORGE CATTELL.
PILOT OFFICER COLIN ROBERTSON.
PILOT OFFICER VERNON WILLIAM LAMOND STANION.
PILOT OFFICER WILLIAM OLIVER DIGBY TWEDDELL.
PILOT OFFICER THOMAS ALLEN WHITING.
PILOT OFFICER REGINALD GEORGE WILLIAMS, A.F.M.

As a squadron commander, one of the above officers has shown great reliability, foresight and devotion to duty in carrying out long-distance raids. In spite of casualties to personnel and damage to aircraft, he has succeeded in maintaining a large proportion of his aircraft in readiness for action.

Another officer, in a period of five days, led three bombing attacks that resulted in a direct hit on an enemy cruiser at Bergen and damage to Stavanger aerodrome.

A third is commander of a squadron that shot down nine enemy aircraft in a few weeks without loss to the unit. By his personal example and leadership this officer has instilled into his squadron a spirit of enthusiasm, keenness and skill.

While reconnoitring Northern Denmark one of these officers discovered large concentrations of enemy aircraft at Aalborg. Three days later he successfully bombed this aerodrome under most adverse weather conditions and in the face of intense opposition from the ground.

Another officer reported the position of the German Fleet and completed a successful reconnaissance although his aircraft was seriously damaged by anti-aircraft fire. A few days later he engaged two enemy aircraft over Norway until damage to his petrol tanks and gun turret forced him to break off the engagement. He then crawled into the wings of his machine and stopped up many of the holes in the tanks, enabling the aircraft to reach its base.

Also on reconnaissance duty, another officer attacked an enemy submarine. He scored a direct hit with a 250lb. bomb. He has been leader of many formations on escort duty.

Two other officers who fly together acting as pilot and navigator alternately have made many daring reconnaissance flights. While searching for a German cruiser they attacked three Flak ships and scored many hits in the face of heavy anti-aircraft fire. A few days later they made a reconnaissance of Hangesund and took photographs from a height of 50 ft. The following day they made a reconnaissance of Frederikshavn and flew so low over the harbour that in the moonlight they were able to make sure that the warship for which they were searching was not there.

Sarll, Squadron Leader James Horatio Gratwick; Cooper, Acting Flight Lieutenant Herbert Douglas Haig.

Sqn. Ldr. Sarll, as captain of an aircraft, displayed skill and tenacity in pressing home a bombing attack on the bridges at Maastricht. A direct hit was scored, and it was subsequently confirmed that a bridge had been destroyed. This officer has taken a leading part in several recent operations of his unit and has consistently shown determination.

Flt. Lt. Cooper led a formation of aircraf

Service Aviation

ordered to undertake bombing operations against Maastricht. In spite of heavy gunfire, the attack was pressed home successfully, the road and railway bridges being heavily bombed, valuable photographs were also obtained.

BAR TO THE DISTINGUISHED FLYING CROSS.

CAREY, PILOT OFFICER FREDERICK, D.F.C.
This officer has shot down four more enemy aircraft, bringing his total to nine. Throughout the operations he was continuously on the search for enemy aircraft and was an inspiration to all who flew with him. His morale was always of the highest order.

STEPHENS, PILOT OFFICER MAURICE MICHAEL, D.F.C.
This officer continued to lead his flight against formations of enemy aircraft of much superior numbers with such good leadership that he rarely lost any members of his formation. In addition, P/O. Stephens brought down four more enemy aircraft recently, bringing his total to eight.

DISTINGUISHED FLYING MEDAL.

Robertson, Sergeant John Stewart.
Sgt. Robertson was the observer in one of a formation of aircraft that undertook bombing operations against Maastricht. Displaying great coolness in the face of heavy anti-aircraft fire, he obtained valuable photographs that showed the destruction of two bridges, and also indicated clearly the route being taken by the enemy through the town and the points at which they were crossing the river by pontoon bridges.

PAINE, SERGEANT JAMES REGINALD.
Sgt. Paine was the air observer of an aircraft of a formation of nine aircraft detailed to carry out a dive bombing attack on a convoy of advancing enemy ground forces on the Belgian frontier. After bombing, the aircraft was engaged in a running fight with four enemy fighters, during which the air gunner was severely wounded. Sgt. Paine immediately crawled through the fuselage, which necessitated removing his flying clothing and parachute, thereby sacrificing a chance of escape if compelled to abandon his aircraft, and succeeded in extricating the wounded air gunner from his cockpit. He then proceeded to operate the rear gun, causing the enemy to break off the attack. He subsequently assisted his wounded comrade after which he returned to his own cockpit and assisted in the navigation of the aircraft. Sgt. Paine's prompt action probably saved the aircraft from being shot down.

SPEAR, SERGEANT ARTHUR NATHAN.
This airman was engaged in bombing operations against the enemy and, after successfully dropping his bombs, he was attacked by a number of Messerschmitts, the tail of his aircraft being shot away. He ordered his crew to abandon the aircraft and was himself thrown out whilst preparing to jump, but he landed by parachute in enemy territory. He was repeatedly under enemy fire but, securing a horse, he succeeded by sheer determination in overcoming many difficulties, including the swimming of a canal, and later returned safely to his Unit.

ODELL, SERGEANT EDWARD NELSON.

TOMLINSON, CORPORAL ROBERT TOD.
These airmen acted as air observer and wireless operator and air gunner respectively in an aircraft piloted by Flt. Lt. Simpson engaged on a low level bombing attack on enemy troops and convoys. After the attack a petrol leak compelled a forced landing, and the aircraft caught fire. These airmen, without thought for their own safety immediately went to the aid of the pilot (who was enveloped in flames) and pulled him clear of the aircraft, which afterwards exploded. Valuable photographs of the bombing and convoy were obtained by Cpl. Tomlinson

KITTO, SERGEANT RICHARD VELLENOWETH TRETHEWEY.

BARBROOK, CORPORAL DRURY JOHN.
These airmen were air observer and air gunner respectively in an aircraft engaged on bombing operations against enemy convoys in May, 1940. Whilst approaching the objective the aircraft was attacked by nine Messerschmitt fighters and was severely damaged. Although rapidly losing height, four bombs were dropped, two of which scored hits. During the dive to the ground these airmen kept up a continuous fire at the enemy fighters. After landing they assisted the pilot to hospital and after many difficulties, including detention in custody (being suspected as spies) they eventually reached their base.

PATTERSON, AIRCRAFTMAN 1ST CLASS GORDON NELSON.
This airman volunteered for duty as wireless operator/air gunner in an aircraft piloted by P.O. Davy in a low level bombing attack on bridges over the Albert Canal in May, 1940. Intense opposition from the ground was met and two attacks by enemy fighters were countered by this airman, but as the port petrol tank appeared to be on fire the pilot ordered the crew to abandon the aircraft and Aircraftman Patterson sustained injuries.

HILLS, SERGEANT ALBERT WILLIAM TREGIDO.
On a night in May, 1940, this airman was first pilot in an aircraft which attacked an objective near Hamburg. In spite of heavy opposition from anti-aircraft defences and searchlights, he pressed home his attack, and obtained direct hits on the objective. On the previous night he successfully located and attacked, under difficult conditions, a target in the Ruhr area. His resourcefulness and courage have been an inspiration to other pilots of the Squadron.

WATHEY, SERGEANT HERBERT.
This airman was air gunner and observer in an aircraft engaged in an attack on a target at Gladbach-Rheydt on a night in May, 1940. Although the aircraft was hit at least five times and severely damaged, one engine being stopped and the rudder controls shot away he continued firing his gun on enemy searchlights and succeeded in putting two of them out of action. When the aircraft was almost unmanageable he assisted the pilot to keep a straight course. His coolness and courage materially assisted a flight of over 100 miles to a place in friendly territory where the crew could abandon the aircraft.

JOLLY, CORPORAL RONALD.
This airman was the wireless operator and air gunner of an aircraft engaged in an attack on a target at Gladbach-Rheydt on a night in May, 1940. The aircraft was severely damaged by anti-aircraft fire, which stopped one engine and shot away the rudder controls, but Cpl. Jolly maintained wireless communication, and obtained positions to assist the pilot and navigator. On reaching friendly territory after a flight of over 100 miles, the pilot gave an order to abandon the aircraft and Cpl. Jolly then destroyed the aircraft's papers, locked the wireless telegraph key, and leaving the transmitter switched on jumped from the aircraft at a very low altitude. His coolness and efficiency throughout materially assisted in preventing the aircraft from falling into the hands of the enemy.

LIGHTFOOT, LEADING AIRCRAFTMAN LIONEL HARVEY.
In May, 1940, this airman was the air gunner of an aircraft engaged in bombing operations against troops and armoured fighting vehicles. After completing the task the aircraft was attacked by a Messerschmitt 109. L./AC. Lightfoot was wounded in the right shoulder; the gun turret was damaged. In spite of this, he displayed the greatest coolness and skill and succeeded in bringing accurate fire to bear on the enemy aircraft, which was afterwards seen to dive into the ground.

ALLARD, SERGEANT GEOFFREY.
This airman has shown outstanding flying ability and at all times his coolness and confidence have assisted all pilots who have flown with him and he has been largely responsible for keeping up the high morale and fighting ability of his section. Altogether in his combats during recent days he has destroyed four enemy aircraft. Without exception he has pressed home his attack with outstanding courage which has been a fine example to his section.

FRIENDSHIP, SERGEANT ALFRED HENRY BASIL.
This airman pilot shot down three enemy aircraft and was at all times conspicuous for his gallantry.

NOWELL, SERGEANT GARETH LEOFRIC.
This pilot recently shot down four, and possibly seven, German aircraft. He has displayed a high standard of courage and devotion to duty. One morning he attacked two enemy aircraft and brought both down. His own aircraft received many hits, but he successfully brought it back to the aerodrome. On the afternoon of the next day, with six other aircraft of his squadron he engaged more than forty enemy aircraft. He showed conspicuous gallantry and dash in driving off the enemy single-seaters and shot down two enemy aircraft. His own engine was hit and he was forced down. Showing great coolness, he landed carefully and avoided personal injuries.

WILKINSON, SERGEANT ROYCE CLIFFORD.
This airman pilot has shot down five enemy aircraft and has displayed a very fine offensive spirit, coupled with a sense of resolute leadership.

AWARDED A BAR TO THE DISTINGUISHED FLYING MEDAL.

FRIENDSHIP, SERGEANT ALFRED HENRY BASIL, D.F.M.
This airman pilot continued to display a very high standard of morale, and brought down three enemy aircraft, bringing his total to six. Sgt. Friendship was always seeking out the enemy to destroy them, and was a most successful leader.

WILKINSON, SERGEANT ROYCE CLIFFORD, D.F.M.
This airman pilot has led his flight on several occasions, and once led the whole squadron on an offensive patrol, during which they not only brought down a number of enemy aircraft but returned without loss. He also led an attack on an enemy motor transport column, blowing up an ammunition lorry and setting two petrol tankers on fire, in the face of heavy anti-aircraft fire. He has recently shot down four enemy aircraft, bringing his total to nine, and has at all times displayed courage and good leadership.

Casualties

Air Ministry Casualty Communique No. 32.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed.

KILLED IN ACTION.—P/O. P. K. Bone (40795); L.A/C. J. Bromley (550718); Sgt. W. J. Cronin, D.F.M. (365686); P/O. H. P. Evans (40377); Sgt. T. R. Kirkham (580599); P/O. R. B. Lines-Roberts (39883); Cpl. R. C. J. Pilgrim (531692); A.Flt. Lt. A. E. Pringle (37299); L.A/C. K. G. Reed (552567).

PREVIOUSLY REPORTED "MISSING," NOW REPORTED "KILLED IN ACTION."—A/C. 1st Class A. Bailey (552069); Sgt. E. Davison (563790); F/O. D. White (39090).

WOUNDED OR INJURED IN ACTION.—A/C. 1st Class J. P. Atkinson (551792); A/C. 2nd Class D. Barber (613054); F/O. P. R. Barr (39482); A/C. 1st Class J. E. Bartley (626100); A/C. 2nd Class P. J. Blandford (621182); P/O. J. S. Booth (41658); F/O. G. H. Bowes (77027); Sgt. R. Brown (562973); P/O. R. G. Buck (77030); A/C. 2nd Class W. J. Cavett (614178); L.A/C. C. E. Coote (549667); L.A/C. C. H. Crowley (550926); Sgt. W. R. B. Currie (564143); Flt. Lt. B. B. st G. Daly (25070); F/O. B. Drake (39095); Sqn. Ldr. N. D. Gilbart-Smith (34041); A. Flt. Lt. G. Harris (37677); P/O. J. E. Hatfield (40474); P/O. C. J. Hitch (41181); A.Sgt. M. H. S. Innes-Jones (566957); P/O. F. P. Joyce (40303); Sgt. C. D. Perry (561615); P/O. C. A. Pownall (36248); L.A/C. V. D. Rawlings (533231); F/O. J. H. C. Rowe (90089); Flt. Lt. W. Simpson (37235); A.Flt. Lt. A. G. Stow (70652); Cpl. R. T. Tomlinson (550950); P/O. E. J. Wicht (41546); P/O. J. E. R. Wood (33448).

PREVIOUSLY REPORTED "MISSING," NOW REPORTED "WOUNDED OR INJURED IN ACTION."—Sgt. J. N. Davis (581208); F/O. C. F. Gibson (39981).

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. A. Colling (580571); Cpl. R. F. Fallows (518379).

MISSING BELIEVED KILLED IN ACTION.—L.A/C. L. D. Davies (537015); Sgt. J. B. Horner (580159); F/O. G. B. Morgan-Dean (40131); P/O. E. E. Morton (40635); A/C. 1st Class A. S. Ross (613676); A/C. 1st Class H. B. Sewell (531362).

MISSING.—Sgt. E. Abbott (564510); Sgt. F. B. Abbott (563017); Sgt. D. A. Allen (740882); F/O. D. H. Allen (39840); Sgt. D. J. Avent (566960); F/O. A. R. Ball (40069); P/O. C. Bellis (39847); A/C. 2nd Class L. A. Berridge (627034); P/O. B. S. Booth (42045); P/O. A. Bouwens (33420); Sgt. J. Brookes (560537); A/C. 2nd Class E. H. Bros (633872); L.A/C. T. W. Brown (534385); A/C. 1st Class T. J. Bryan (531862); A.Flt. Lt. M. M. Carter (70119); F/O. T. C. Clarke (25129); F/O. L. R. Clisby (40043); F/O. W. C. G. Cogman (39274); L.A/C. E. W. L. Cooper (539921); Sgt. J. T. Craig (564573); F/O. J. F. R. Crane (39858); Sgt. J. K. Crawley (580572); Sgt. A. G. B. Crouch (580508); Cpl. T. H. Cummins (537830); P/O. K. M. A. De Souza (41679); Flt. Lt. S. Dodds (37086); A/C. 1st Class J. L. Durant (627040); L.A/C. D. S. Edmondson (543850); F/O. E. C. Ford (25130); F/O. D. A. J. Foster (39655); P/O. C. R. Frankish (40616); F/O. A. M. Gofton (39312); F/O. K. W. Graham (72424); Sgt. J. J. Grierson (516360); L.A/C. A. H. Gumbleton (538552); Cpl. R. E. Gumbrill (520854); Sgt. N. T. W. Harper (563534); A/C. 1st Class T. W. Holloway (620475); L.A/C. R. D. Hughes (551679); F/O. G. D. O. le M. Hutchesson (39283); F/O. J. Ing (39987); L.A/C. N. E. Jacobs (562265); Sgt. A. G. Johnson (563884); Sgt. W. Jones (563455); P/O. C. B. Jordan (39991); Sgt. E. A. Judge (565431); P/O. O. H. Keedwell (41427); A.Sgt. A. V. Knowles (530226); Sgt. D. J. Lees (565583); P/O. R. J. Lennox-French (77120); L.A/C. T. J. Lowry (553205); P/O. K. R. Lucas (41854); A/C. 2nd Class W. J. McCarthy (625295); P/O. I. A. McIntosh (40631); P/O. J. D. B. McKenzie (40726); L.A/C. R. P. McNaughton (535838); P/O. R. I. C. Macpherson (42141); L.A/C. S. A. Maddox (551172); A/C. 2nd Class A. H. Malkin (631632); Sgt. L. J. Merritt (563345); Cpl. A. J. Metcalfe (516026); A/C. 1st Class H. C. Mewett (622864); Sgt. R. Miller (515573); P/O. Miller (40411); F/O. J. C. Milner (39553); A/C. 2nd Class E. Mold (626134); Sgt. A. T. Morland (581238); L.A/C. R. Morris (551580); Sgt. D. V. Moseley (755471); Sgt. R. E. Newbatt (580271); L.A/C. J. R. Nicholson (620766); A/C. 1st Class W. J. Nolan (613363); F/O. A. E. Oakley (36132); A/C. 1st Class W. Parker (625250); L.A/C. K. Parry (550953); A/C. 2nd Class J. H. Patterson (626953); Sgt. J. W. Paul (581002); F/O. A. C. Peach (40256); P/O. J. O'B. Power (40850); Sgt. T. B. G. Pyne (565921); Sgt. E. G. Roberts (563483); Sgt. J. C. Robertson (749443); P/O. C. S. Robinson (41470); A/C. 2nd Class S. Robinson (632800); A/C. 1st Class W. S. Rodulson (551863); P/O. P. G. Royle (42152); A.Flt. Lt. H. C. Sammels (37901); Sgt. C. Shelton-Jones (563688); P/O. S. A. C. Sibley (33549); A/C. 2nd Class G. B. Smith (621323); P/O. N. A. L. Smith (40950); Sgt. P. McK. Southwood (580531); A/C. 1st Class F. T. Spencer (618586); Sgt. D. T. Stuart-Harris (580593); Sgt. K. V. Thrift (580889); P/O. K. S. Toft (708791); A/C. 1st Class W. A. Tomlinson (550609); Flt. Sgt. G. A. Turner (564783); Sgt. J. D. Turner (564992); Sqn. Ldr. W. H. N. Turner (26216); F/O. E. R. D. Vaughan (37838); P/O. P. W. Vaughan (33493); L.A/C. A. E. Waddington (638743); Sgt. H. D. Welch (565950); Sgt. E. F. White (581009); L.A/C. D. V. Woods (551566); Sgt. E. F. Woods (581254); A/C. 1st Class J. D. Wright (550302).

KILLED ON ACTIVE SERVICE.—A/C. 2nd Class C. L. Crowcroft (650296); Sgt. S. F. H. Keene (514292); L.A/C. J. H. Marriott (537418); L.A/C. D. Morton (551750); P/O. M. L. Patton-Bethune (74340); A.Sgt. K. A. Stokes (755232); Sgt. C. D. Thorn (742760); A/C. 2nd Class D. Wightman (903325).

PREVIOUSLY REPORTED "MISSING BELIEVED KILLED," NOW PRESUMED "KILLED ON ACTIVE SERVICE."—P/O. D. E. Ryder (40023).

PREVIOUSLY REPORTED "MISSING," NOW PRESUMED "KILLED ON ACTIVE SERVICE."—L.A/C. R. F. Petts (524461).

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. W. F. Prichard (519023); Sgt. R. P. Stilwell (516888).

DIED OF WOUNDS AND INJURIES RECEIVED ON ACTIVE SERVICE.—A/C. 2nd Class W. J. Bolton. (756194).

DIED ON ACTIVE SERVICE.—Cpl. A. R. Bradshaw (16373); A/C. 2nd Class R. W. Coles (639044); A/C. 1st Class H. Dockray (645116); A/C. 2nd Class D. H. Gourlev (977978); Flt. Lt. W. D. Guyler (23107); A/C. 2nd Class J. R. Price (979335); A/C. 2nd Class L. Rodham (945850).

PREVIOUSLY REPORTED "MISSING," NOW REPORTED "SAFE."—A/C. 2nd Class R. W. Bence (619972); Sgt. J. Christie (517808); F/O. A. D. Panton, D.F.C. (33331); Sqn. Ldr. G. C. Tomlinson (05214).

PREVIOUSLY REPORTED "MISSING," NOW REPORTED "PRISONER OF WAR."—Sgt. J. R. Brooker (564099); F/O. R. M. Burns (33304); A.Sgt. Ldr. K. C. Doran, D.F.C. (37467); A/C. 2nd Class W. Draper (617133); Sgt. A. W. H. Hadley (580490); Cpl. G. Hurford (521567); Sgt. E. E. B. Le-Voi (562560); Cpl. R. K. Rye (551184); Sgt. J. C. Sands (515799).

RE-SITE THE AIRCRAFT INDUSTRY

Standardise Types and Shift Factories to the Dominions

By CAPTAIN NORMAN MACMILLAN, M.C., A.F.C.

THE strategy and tactics of conquest are not identical with the strategy and tactics of resistance to conquest. Terminologically, there is as much difference between them as exists between a synonym and an antonym. Hence it follows that the military commander who excels in attack is not necessarily the best leader in defence, and *vice versa*.

For years—even before the advent of the third Reich under the Nazi régime—German military leaders dreamed of the redemption of the defeat of 1918 by force of arms. The pace of their thoughts was quickened when Herr Hitler became Chancellor in 1933. When he became President everything was subordinated to but one end—and that end the British and French Empires are now opposing.

For eighty years German militarists have pursued the study of conquest. Time after time they have put their theories to the test. And their latest theory is to use aircraft as the spearhead of a mobile army moving against the immediate foe. Bombs bludgeon down resistance by forcing opposing troops to take cover while armoured and mechanised ground forces advance. Bombs and machine guns fired from aircraft throw the civil population into rout and confusion, and cause an inextricable mix-up of fleeing civilians and defensive troops. All tactical points in the immediate rear of the defenders are shattered by air attack. The essence of the whole operation is speed. The Nazi conception of military strategy will work, and continue to work, so long as the sweep of movement can continue. It will cease to work when the movement of the armed and armoured hordes ceases.

Allied Resources

Three things can hold up that movement. One is the opposition of superior force in men and machines. Another is a sufficiently powerful natural barrier. And the third is the exhaustion of Germany's resources in men and machines. As things stand, it looks as though a combination of all three is the aim of the long-term strategy of the Allies; and, be it noted, to the Allies alone is such a combination possible. But we need time.

We have done little more than scratch at the surface of the resources in men and material of the British Commonwealth. And while the Governments of Holland and Belgium stand fast with the Allies, we can draw upon the resources of their Colonial possessions in addition to those of France. To the Allies is open the latent power of industrial production in the United States. To the Allies is open the great food areas of the Western hemisphere. Thus, the Allied reserve in material, in food and in the creation of machines of war, is almost inexhaustible.

That Barrier

Germany's resources, on the other hand, have been drawn upon to capacity. In men, in machines, the whole nation has been converted into a war mechanism. Her man power is being mown down by bullet, shell and bomb, and she has no reserve—unless, indeed, Italy acts as her reserve of men and machines. There lies Germany's one war potential. Her own has passed the peak.

The first and third processes are simultaneously working for the benefit of the Allies. Against that process Hitler can balance only the latent strength of Italy. But even that power, added to the power of Germany as it is to-day, is assessable by the Allies; and, given time, it, too, can be bested.

The other consideration is the natural barrier. Obviously, at the moment, it consists of the North Sea, the English Channel and the Straits of Dover. If Germany cannot cross that barrier she cannot win this war whether Italy enters it upon her side or not. Never did the Prime Minister speak words more true than when he said that the people of this country have only to hold out to win through to the defeat of Nazism.

What Next?

In one sense this war is only just beginning. What has happened up to date (including the capitulation of the Belgian Army) is, as it were, a prelude to the real struggle. All the indications are that the great air war between Germany and Britain may begin at any moment. There is one proviso—Will Germany, with or without Italy, try to settle with France individually first? Will her next blow be directed against the Army that defends the line of the Somme and the Aisne? Or will she be content to hold that force in check and turn her air squadrons against the British Isles? Or will she enter upon yet a fresh course and march against the Balkans? It may be that Italy would not consent to enter the war upon the side of Germany unless Germany were prepared at once to throw a part of her armies against the Balkans.

Whichever course the war may follow from now on it is ever increasingly clear that the most important shortcoming that Britain must make good is the Allied inferiority in aircraft. This inferiority is a numerical one; the quality of the Allied aircraft is superior to the quality of German aircraft. The quality of the British pilots, battling against superior numbers, is far higher than that of their German opponents, good as they may be—indeed, I have reason to believe that the British pilots do not belittle their opponents' skill. Nevertheless, the Royal Air Force has the *Luftwaffe* whacked except in this important matter of numbers of machines.

Our Late Start

It is our folly in allowing the German air force to out-build us that we have to thank for some—indeed most—of the difficulties with which the Allies are now faced. And of that folly and how it arose I could say much, and as much again upon the subject of how it was perpetuated—except that this is no time for recriminations. Nevertheless, I do not see why those who are responsible for the paucity of British aircraft should not be held responsible just as much as others are held responsible for the things that they have done or have left undone. Let us get down to brass tacks. We want to win this war. We must win it. So, if we have made mistakes in the past, we must own up to them, not try to smother them and cover them up as is the way in times of peace. I bet some people in this country wish they could go back five years and begin again. But that is impossible. We have got to begin again now, when the going is so much worse. Nevertheless, if we do so and do it rightly this time, we shall win this war no matter how dark the times may be

through which we shall have to pass before victory is achieved. But it can no more be done now by utilising the orthodox methods of the past than could it be done by accepting the theories of Sea Power (without correlating them properly to Air Power) and giving them priority five years ago.

The British Empire possesses untapped sources of strength. They ought to have been tapped long ago, but they were not. A tardy start was made with the training of pilots and other members of aeroplane crews in the Empire countries. It ought to have been begun years before, when it was first suggested. So with the building of aircraft. They ought to be under construction in bigger quantities outside Great Britain than within our seagirt shores, which lie too near the shores of Continental Europe; but it is the other way about. Everything we have done in the last five years has been the other way about. To-day we are not only making the United Kingdom the principal arsenal for the defence of the whole Empire, but we are perpetuating that mistake in spite of the fact that the Prime Minister has warned the British people that the forces which have been turned against Norway and Holland and Belgium are likely to be turned against us here in these islands. Why, oh why do we remain so blind?

Decentralise to Dominions

Years ago I pleaded that Great Britain should not be made the arsenal of Empire. I visualised Great Britain as the advanced zone wherein actions would be fought and in which our advanced bases would be situated. But to place one's factories and stores in the same area as one's advanced bases is madness. I believe it is not too late to do much, even now. Why not despatch complete aeroplane design staffs to Canada? Why not send trained men out there, too; workmen, ship equipment, tools, jigs; all the paraphernalia of the aircraft industry? Ship the industries that feed it. Make Canada our war base. Make Australia a second base. New Zealand a third. If we are getting their men as fighters, soldiers, as we are, we can replace them by British workers.

After all, we are a moated castle here in the United Kingdom. Vulnerable to air attack we are and must be. But we are not accessible to tanks moving under their own power. Great Britain should become a forward battle zone. All redundant males, females and children ought to be cleared out and not left to become pitiable refugees. We know well enough that the German pilot will shoot at refugees, will bomb them. To clear them out to the western counties is not enough. Our strength lies in the fact that we can evacuate the United Kingdom. Germany cannot evacuate the heart of Europe—not yet. She may have, indeed she has, numerous factories sited far apart within the Greater Reich. But she cannot put them into places of safety as can the British Empire.

Invincibility

If Britain acts now, even as the clock approaches the twelfth hour we may yet have time to recover from the shortsightedness of our leaders in the past, who have left undone the things that ought to have been done. If we can keep our aircraft industry intact within the Empire, if we can keep our design staffs and our workmen for that industry in places of complete safety, if we can shift our machine tools and factories and re-erect them where they can carry on inviolate despite the ravages of war, the Navy will have done a job that will make the British Empire and the English and French speaking peoples invincible.

Then, at one stroke, we shall have accomplished a number of things. We shall have a huge and growing aircraft industry established in parts of the Empire that are inviolate in the present stage of the struggle, and which we shall thus make strong enough to withstand assault at any later stage. We shall render it impossible for Germany and any ally she might possess to defeat the British people by a European struggle. We shall have forced the industry to produce and the Royal Air Force to employ the types of aircraft most necessary for the kind of campaign in which we are engaged. We shall have a truly mobile air force.

The British Commonwealth

Our air force should then be renamed. It ought even now to be called the Royal Empire Air Force. Its training grounds, and the industry that makes its aeroplanes and equipment ought to be situated throughout the Empire. In the United Kingdom should be the advanced base repair shops and a number of constructing factories working under war conditions, making only certain things. There would be reception aerodromes sited as far west as possible in the country. To them would come a steady stream of new aircraft, and new crews trained in the tonic atmosphere of the Dominions. In the United Kingdom we should have plenty to do. There would be factories to make munitions, for one would not want to carry bombs, for example, farther than was necessary. There would be reserve bomb factories overseas as well.

Germany might overrun all Europe. We might hold her east and southward drive somewhere in that vague region called the Middle East. If we can hold these islands, too, Germany cannot prevail. To win we need far better organisation than we yet have had. We need an outlook that embraces our Imperial domains, which are in the main far removed from Imperialism, and which will sweep them into a real Commonwealth wherein our money is their money and wherein we shall not hesitate to spend upon the erection of factories as freely as we would spend if we were building these same factories in the United Kingdom.

Standardise

We should also have to concentrate upon the utmost speed of output of the most suitable aeroplanes. They would have to be long-range aircraft able to fly the Atlantic non-stop with ease. They would have to be fast, faster than anything yet flying, in their class. We should want just one type at a time. One bomber—the best. We should have to scrap, for the time being, all the industrial pride of names. The prefixes of Hawker, Fairey, Handley Page, Vickers would have to go, as well as all the others. We need just one bomber. We do not need a mixed bag of Wellingtons, Hampdens and Whitleys. We want just one, with the best qualities of all. And there is no reason why we should not get it, and have it produced in greater numbers than we have so far achieved with our mixed grills of bombers. By comparison with Germany it almost seems as though Great Britain has been suffering from a conspiracy of slowness. Now, the aircraft industry had better face the fact that it has a choice of alternatives—production or extinction. Some of the leaders of the industry have had too soft a time for too long a time. Now they could profitably spend twenty hours a day planning the transformation of their plants from United Kingdom to Empire soil. Let them get on with that job before it is too late, without waiting to discuss the question of profit or loss. If they dally too long it may be all loss.

Fighters and the shorter range dive-bombers we can continue to make in the factories that are left here. With them (and a proportion of heavy bombers) we should be able to carry on, for the interim period, the war at the closer ranges of to-day.

MACHINE OF THE WEEK : Everyone expected the Boulton Paul Defiant turret fighters to put up an outstanding performance once they came to grips with the Germans, but probably not even the Defiant's designer, Mr. J. D. North, foresaw that in one of their first engagements a formation of these magnificent machines would destroy thirty-seven enemy aircraft without loss to themselves. Here is a new *Flight* drawing of the Defiant showing the location of the four-gun turret.

HERE and THERE

A Glasgow Show

ANOTHER of Mr. J. H. Stroud's exhibitions is to open on Monday, June 17, at Rowans, Ltd., Buchanan St., Glasgow. Models, photographs and drawings of British and enemy aircraft are to be shown, the object being to assist civilians in the identification of aircraft. A number of *Flight* photographs are included in the exhibition.

Lisbon Service

THE first departure on the new twice-weekly regular service to Lisbon by British Overseas Airways was made from a London aerodrome just before 9 a.m. on the morning of June 4. The De Havilland Albatross *Fingal*, under the command of Capt. O. P. Jones, carried seven passengers and mail when she took off. Some of the mail was destined for Portugal, with the remainder to cross the Atlantic by Pan American Clipper for the United States, Canada, and South America. Preparatory flights were started on this route on April 9, and on the last of these, a week ago, Sir Samuel Hoare was carried on his diplomatic mission to Spain.

A Signal Honour

MR. F. S. SPRIGGS, the President of the Society of British Aircraft Constructors, has been unanimously elected an Honorary Fellow of the Royal Aeronautical Society. This is an honour very rarely conferred, and indicates the keen appreciation of the practical and technical services which he has rendered to aeronautics.

As Managing Director of the Hawker Siddeley Aircraft Co., Ltd., Mr. Spriggs controls an organisation which has played an important part in the expansion of our aircraft production programme, and within the past month he has been appointed chairman of two committees by the Minister of Aircraft Production: the committee on Light Alloys and the committee on Airframe Production.

Air Mail Pick-up

RECENT floods in the Ohio River Valley were severe enough to prevent mail delivery by rail and road, but All American Aviation Inc. kept communications open by dropping and picking up mail. Mail is picked up from a line between two poles with a technique very similar to that used in army co-operation work.

Mr. L. P. Lord

LORD BEAVERBROOK, Minister of Aircraft Production, has appointed Mr. Leonard P. Lord as Government manager of the Boulton Paul Aircraft Works. This arrangement has been approved by Lord Gorell, chairman of the company, and his colleagues.

Mr. Lord was formerly managing director of the Morris Motors group and later became works manager of Austin Motors.

Identifying Troop Carriers

GERMAN Troop Carriers is the subject of the latest identification chart issued by *Flight*. Priced at sixpence, post free, nine views of troop carriers, as well as views of the German type of parachute, are embodied on a card measuring 12½in. by 10in., which is folded conveniently for carrying in the breast pocket. Obtainable from Iliffe & Sons, Ltd., Dorset House, Stamford St., London, S.E.1.

THE INDUSTRY

Flat Out

ACCOMMODATION for the increased number of men employed on the "speed up" air programme at the Isle of Wight was difficult to obtain, and to solve the problem Saunders-Roe, Ltd., have purchased houses and converted them into flats which are available to employees at low rentals. Here, too, are accommodated those trained at a school Saunders-Roe opened to instruct unskilled men in metal drilling, turning, milling, riveting and aircraft fitting. These men are paid wages while learning, and after a course are drafted to the factory to help in the construction of flying boats. The training is not intended to enable the men to compete with skilled labour, but merely to provide qualifications to help in certain directions in aircraft production. Most of the men so trained are recruited from Labour Exchanges, but many not of military age have left other employment to join the scheme.

Globe Trotter

TECALEMIT, LIMITED, Great West Road, Brentford, Middlesex, the well-known manufacturers in this country of high-pressure lubricating appliances for all engineering trades including industrial, aircraft and the motor trade, have decided to investigate the market conditions within the British Empire.

Mr. Cyril Viner, who has been with the company for many years, is leaving immediately by air, his first objectives being Australia and New Zealand where he expects to remain for a period of 3-4 months, visiting the various industrial centres.

When one considers the enormous field that lies before him in which to preach the gospel, Mr. Viner is to be congratulated on the opportunity thus presented. We have no doubt that this will result in increased business from the Empire overseas.

Solders and Soldering

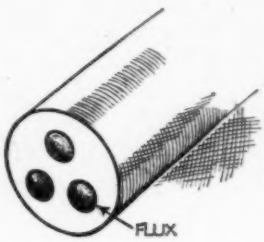
PRIOR to the outbreak of war, it seems that many British and Colonial electrical and radio manufacturers who used cored solder with special fluxes, used to obtain much of their supplies from Germany. Although single-cored solder, with rosin flux, was made in England, there was, with few exceptions, little cored solder available of British manufacture containing special fluxes.

Since the outbreak of war, Multicore Solders, Ltd., have developed their cored solder, which contains three independent cores of Ersin flux.

Ersin Multicore Solder is now being used by many of the leading manufacturers and, with a view to developing the export markets, which were previously served by Germany, Multicore Solders, Limited, have produced a most useful twenty-page illustrated booklet, "Solders and Soldering."

Amongst the tables of useful data is one of special interest giving the approximate number of feet per lb. of Multicore Solder in its various alloys. A study of this table by the progressive manufacturer should enable considerable savings to be made in soldering processes, by the avoidance of waste. It is seen, for example, that with a 60 per cent. tin alloy, more than three times the length of solder can be obtained by using 18 S.W.G. Multicore Solder instead of 13 S.W.G.

Copies of this booklet will be sent, free of charge, on request to the principals or Chief Research Engineers or firms using solder, by applying direct to the Head Offices of Multicore Solders, Ltd., at Bush House, London, W.C.2.



The Multicore solder showing how the flux is contained in three cores

Thermostat Service

A SUBSTANTIAL amount of foreign-made control equipment is still in use in this country, both for refrigeration and air-conditioning installations, and in industrial applications. One reason, of course, is that the plant which is controlled may also be of foreign manufacture and that it was originally supplied complete with control equipment. Owing to wartime restrictions, however, users are now finding it difficult or even impossible to obtain further supplies, either for the replacement of existing gear or for new installations, and in some cases it is not possible to have even urgent repairs carried out.

There has always been, at The British Thermostat Co.'s works, a department organised to build special equipment to meet individual requirements, and this department has recently been greatly extended in scope. It is now able to undertake the production in small or large quantities, of control equipment to meet any specified conditions. Frequently a standard instrument of the firm's manufacture can be used as a substitute for a foreign-made control, or an existing model can be modified to suit special requirements. Moreover, the Company's experience of heat control problems is so wide that there are few applications which have not, at one time or another, been dealt with by them.

If, however, an application is such as to call for an entirely new design, the department to which we have referred is fully capable of tackling the job. The scope of the Company's repair and service organisation has also been widened to embrace repair work on equipment other than the Company's own make, and the services of this department also are available to engineers using foreign-made controls which are in need of repair. The department dealing with repair and replacement of foreign apparatus is part of the British Thermostat Company's works at Windmill Road, Sunbury-on-Thames, Middlesex.

Tin Research

TO-DAY when the industries of the country are concentrating on a rapid increase in the production of war material, new problems are bound to arise.

The International Tin Research and Development Council would like us to emphasise that it has accumulated much experience, particularly since the war began, on a wide range of processes in which tin is directly or indirectly concerned, and that this experience is available, without charge, to any manufacturer. These processes include: Grease-tinning and hot-tinning, soldering, bearings and bearing materials, bronze, electro-tinning and fusible alloys, particularly for rapid die and punch mounting

Advice can sometimes be given by correspondence, but as in many cases personal contact is much more effective, they are prepared to send members of their staff to give assistance and advice at manufacturers' works. The address of the offices and laboratories is Fraser Road, Greenford, Middx.

AERONAUTICAL PATENT SPECIFICATIONS.

27187. AIRCRAFT COMPONENTS, LTD., and BOUND, R. H. Fluid-pressure systems for operating aircraft parts (519,212).

27275. DAIMLER-BENZ AKT.-GES. Guidance and springing of vehicle axles (519,316).

27340. VICKERS, INC. Hydraulic feed control system (519,321).

27341. VICKERS, INC. Irreversible power-transmission mechanism (519,322).

27458. SMITH AND SONS (MOTOR ACCESSORIES), LTD., and MEREDITH, F. W. Control surfaces for air and water craft (519,337).

28705. VICKERS-ARMSTRONGS, LTD., and CLIFTON, J. C. Optical measuring-apparatus (519,228).

28970. JUNKERS FLUGZEUG-UND-MOTORENWERKE AKT.-GES. Supporting-surfaces for aircraft (519,236).

29334. SMITH, J. W. Variable-pitch propellers for aircraft (519,261).

29450. SMITH, J. W. Aeronautical propeller-blade mounting (519,267).

29564. SOC. D'INVENTIONS AERONAUTIQUES ET MECANIQUES S.I.A.M., and LEVY, R. L. Aeroplane landing-gear (519,275).

29758. VICKERS, INC. Pressure-control units for variable-delivery pumps (519,290).

29790. KOLLSMAN, P. Indicating-means for indicating devices (519,346).

25410. CREED, F. G. Floating structures, stations, and seadromes (518,634).

25590. I.G. FARBENINDUSTRIE AKT.-GES. Covering for aeroplanes and the like (518,645).

28624 ELLIS, T. R., and WHARMBY, E. Adjustable levelling staff on which the level of a point above or below mean sea level or other datum can be read at sight (518,459).

1939

20512. AIR-EQUIPMENT. Retractable landing-gear for aircraft (518,511).

(Published April 25th, 1940.)

1938.

18705. AIRSPEED (1934), LTD., TILTMAN, A. H., and ELLISON, A. E. Control systems for aeroplanes (519,519)

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